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Changing Currents of Geographic Thought in America*

CHARLES C. COLBY

The science of geography stands uppermost in the thought of those assembled here this evening, just as it has stood uppermost in the thought at all previous meetings of this Association. Many of us trained under or worked with the distinguished men who founded this Association, who charted its early course and whose papers made up its programs. Many of us, also, have been counseled, guided and criticized by one or more of them. All of us have been stimulated by their ideas and their creative output. In large measure we owe them our ever-increasing opportunities to live and work in the domain of geography. Most of all we owe them a scientific heritage which is our greatest asset and our greatest responsibility.

The men who founded our Association were, in their turn, preceded by a long list of scientifically experienced and geographically minded men—a list which carries back to the beginning of our country. During this century and a half of geographical work which lies back of us, however, the science, like the country, has witnessed a notable development. In many instances, the center of thought in one period has not been the center of thought of succeeding periods. Some concepts have appeared only to disappear, others have appeared and reappeared from time to time, while still others have held their sway throughout the decades. It is with these changing currents of geographic thought that I am concerned tonight. Our examination will be facilitated if we look first backward and then forward

* Presidential address delivered before the Association of American Geographers, St. Louis, Missouri, December, 1935.

from 1903, the year which marks the beginning of this Association. In that connection we stand tonight on hallowed ground, for the idea of an organization devoted to scientific geography was first broached at a scientific meeting in St. Louis in 1903.

At the outset I want to call attention to two questions which to some extent motivated this examination of geographic thought. The first one grows out of a curiosity as to the intellectual qualities called into action during the progress of a geographical investigation. Does geographical investigation require analysis as well as synthesis, discovery as well as description, and prediction as well as formulation?[1] If it does, it should take its place in learned circles and in public esteem with other basic sciences. The second question springs from the oft-discussed assertion that geography has no distinctive phenomena at the center of its interest, as have, for example, soil science, botany, and chemistry. Does geography, like those sciences, deal with phenomena which are distinctly its own? Although I did not set out specifically to answer those questions, I found in the records of geographic thought in this country much evidence in support of the conclusion that the answer to each is in the affirmative.

MEASUREMENT AND SUBDIVISION OF LAND AREAS

The measurement and subdivision of land areas was the first concern of geography in this country. This grew out of the fact that almost as soon as the Union was established the government of the United States became custodian or trustee of lands acquired for the nation from the colonies under the confederation and from the states under the constitution. These lands were known as the public or national domain and after they had been organized into geographical divisions were ordered surveyed.[2] Under the ordinance of May 20, 1785, the officer in charge of this survey of the public lands was called the "Geographer of the United States."[3] Serving under him was a surveyor for each state and under his direction these men carried out the subdivision of the lands preparatory to sale. In his instructions to an early incumbent of this office, President Jefferson wrote, "We have been wanting also . . . accurate determination by astronomical obser-

[1] Douglas Johnson raised this question in his presidential address in 1928, published in these *Annals*, Vol. XIX, 1929, p. 212.

[2] Donaldson, Thomas, *The Public Domain, H. R. Ex. Doc. 47, Part 4, 46th Congress, 3d Session*, Washington, 1884, pp. 196–202.

[3] Thomas Hutchins (1730–1789) was appointed to this office. He had served as geographer-general under General Greene and had published "Topographical Description of Virginia, Pennsylvania, Maryland and North Carolina" (1778) and "History, Narrative, and Topographical Description of Louisiana and Western Florida" (1784).

vations of several points and lines in our geography very interesting to us."[4] Geography, therefore, found official recognition through its command of the technique of measurement. The first geographer was concerned with the segregation, delimitation, and subdivision of land areas for sale, in other words, with the creation of a pattern in which people could live and work.

At the outset the public land surveys were accurately placed, the principal meridians and the principal east and west lines being established by astronomical observations, and important improvements were made in the period from 1803 to 1813. Later the practice of orienting the major lines of the surveys to latitudinal and longitudinal lines "appears to have fallen into desuetude" and as one writer points out, "more than eighty-five years later the General Land Office is found prosecuting its subdivisions, substantially unaided by these geographic connections and checks, demanded alike by the scientific progress of the world and the requirements of a reasonable accuracy."[5] This failure to tie their later work to a network of cardinal points can not be charged to geography, for under the act of May 18, 1796. the title of the directing officer was changed from Geographer to Surveyor General. With the change of administration the idea of geographical accuracy gradually dropped out of the General Land Surveys, but it did not drop out of men's minds, for in 1884 before a Joint Commission of the Congress, Major Powell, Director of the Geological Survey, emphasized the great loss to science and to the country growing out of the failure of the Land Office to tie its surveys to lines of latitude and longitude.[6] He pointed out that "The sense in which the terms parallel and meridian are used in the Land Office is altogether different from the sense in which they are used by geographers" and that their surveys became simply planimetric, with their meridians marked on the ground with stakes. Thus in case the stakes were lost, the lines could not be found. Subsequently this absence of accuracy in pattern led to many disputes and much costly litigation. In his extensive comments on the matter before a Congressional Committee Major Powell makes an urgent plea for accuracy in measurement—a plea which is still in accord with the spirit and practice of scientific geography.[7]

[4] Wheeler, Capt. Geo. M., *Report upon United States Geographical Surveys West of the One Hundredth Meridian, Engineer Department, U. S. Army, Vol. I, Geographical Report,* Washington, 1889, pp. 405–408. See also Conover, Milton, *The General Land Office,* Institute for Government Research, Baltimore, 1923, pp. 7–8.

[5] Wheeler, Capt. Geo. M., *op. cit.,* p. 408.

[6] Powell, John W., *On the Organization of Scientific Work of the General Government,* Washington, 1885, pp. 1, 10, 12, 15. See also Wheeler, Capt. Geo. M., *op. cit.,* pp. 410–411.

[7] See Bowman, Isaiah, "Measurement in Geography," *Geography in Relation to the Social Sciences,* New York, 1934, Chap. II, pp. 40–63.

FILLING THE CHASMS IN THE MAP

Exploration of the areas represented by the blank spaces on the map occupied the center of geographic thought in America for many decades following the purchase of Louisiana by President Jefferson in 1803. This purchase represented an act based on logical geographic thought by a president who, according to General A. W. Greeley, was one of the greatest of American geographers.[8] Jefferson recognized the great importance of the Mississippi River as an artery of commerce and realized that the Gulf of Mexico was the only natural southern boundary of the United States of that period. When once the great territory was added to the Union, Jefferson again displayed the geographic quality of his mind by initiating exploration of its immense and unknown areas. He dispatched Lewis and Clark on an expedition in which they discovered the upper Columbia River and aided in the acquisition of Oregon. The information which these explorers brought back, together with that resulting from Pike's expeditions, initiated a great period of exploration and discovery. Further evidence of the geographic quality of Jefferson's mind is the fact that in 1807 he recommended to Congress the establishment of a national coast survey, the forerunner of the present United States Coast and Geodetic Survey. In Jefferson's time the country enjoyed an extensive overseas and coastwise commerce, and it was his realization of the value of accurate maps and charts to the shipping which carried this commerce that led Jefferson to recommend the establishment of a coast survey.[9]

The striking results of the early expeditions excited the curiosity of the country, and curiosity is a powerful motive in scientific discovery. For many years the country itself was a great unknown, and geographical science, as well as many other sciences, was in the making. Men of widely varying interests gave their time, their money, and in many cases their lives to the exploration of the "Great West." From these explorations came books, pamphlets, and government reports in great number. Undoubtedly these added much to the ever-increasing knowledge of the country. Much of the writing, however, was fragmentary in coverage and vague as to locality. The maps included in the reports, and other maps prepared at the time, with their need for some modicum of precision, clearly were the

[8] In an address at Monticello in 1896, General Greeley said of Jefferson: "While we pay tribute to Jefferson as an individual, as a citizen, as a lover of liberty, and as a President, let us not forget his special claim to recognition as one of the greatest of American geographers." See "Jefferson as a Geographer," *Nat. Geogr. Mag.*, Vol. VII, No. 8, August, 1896, p. 271.

[9] *Centennial Celebration of the United States Coast and Geodetic Survey*, Washington, 1916, p. 59.

most effective instruments in consolidating the results of the early explorations. During these decades of exploration the task of reducing knowledge to map form, or, as one early writer puts it, "filling the geographical chasms in the map," almost universally was considered a geographic function. As might be expected, maps of the period vary greatly in accuracy, but the more scientifically minded among the map makers recognized the difference between maps based on actual observations and those based on generalities. Frémont, for example, voiced a rebellion against careless mapping when he wrote, "The map which illustrated the report of 1842 is now extended to illustrate the entire expedition of 1843–44, so that a view of both expeditions will be presented together. This map may have a meager and skeleton appearance to the general eye, but is expected to be more valuable to science on that account, being wholly founded upon positive data and actual operations in the field . . . nothing supposititious has been admitted upon it; so that connecting with Captain Wilkes's survey of the mouth of the Columbia, and with authentic surveys of the state of Missouri, it fills up the vast geographical chasm between these two remote points, and presents a connected and accurate view of our continent from the Mississippi River to the Pacific Ocean."[10] Geographers still are busy filling the chasms in the map, but the chasms of today are of a different sort than those of Frémont's time.

AN ORGANIZATION FOR PROMOTING GEOGRAPHIC THOUGHT

Interest in exploration not only in America but in other parts of the world found expression in 1852 in the founding of the American Geographical and Statistical Society. Apparently the founders borrowed the idea from Europe, where several geographical societies had come into existence in the preceding decades. The founding of the New York society by men of means and distinction initiated a chain of circumstances of much importance to American geography. The Society began publication in 1852, and with the exception of the decade of the Civil War its publications furnish a continuous record of geographical thought for more than four-fifths of a century.

Of its early publications, the issues for 1854 and 1859 are particularly revealing of the geographic thought at the middle of last century.[11] The

[10] Frémont, Brevet Captain J. C., *Report of the Exploring Expedition to the Rocky Mountains in the Year 1842 and to Oregon and North California in the Years 1843–44*, Washington, 1845, pp. 3–4.

[11] *Bulletin of the American Geographical and Statistical Society*, Vol. I—Part III for the Year 1854, and *Journal of the American Geographical and Statistical Society*, Vol. 1, Nos. 1 to 10, inclusive, monthly except for August and September, 1859.

volume for 1854 shows the society in its most persistent interest, namely, exploration. In the annual address given by Lieut. M. F. Maury, LL.D., in February, 1854, attention is called to the fact that although no ship had actually made the Northwest Passage, navigators from the east had met navigators from the west, had shaken hands across the ice and thus had solved "the geographical problem that for ages has baffled the world." A report of an expedition to the Amazon was included in the issue for 1854, as were descriptive articles on Natal and the Isthmus of Panama. Attention also was called to the fact that according to Humboldt a new branch of science, the physical geography of the sea, had come into being through the scientific work of the United States Navy.

The ten issues in 1859 show the Society in quite a different light. The titles resemble those of the present day and the content of the articles clearly forecast the twentieth century interest in ecomonic and regional geography. Representative titles are "The Geography and Resources of Arizona and Sonora"; "A Statistical View of American Agriculture, Its Home Resources and Foreign Markets," by John Jay, Esq., Chairman of the Agricultural Section of the Society; and "South Carolina: Her Natural Resources and Agricultural Products." The last article is accompanied by two maps in color showing the forest belts, the principal mineral areas, and the boundaries of the areas occupied by leading agricultural products. Another line of thought which appears in 1859 and which is not without exponents at the present time is an article dealing with "The Value of Geography to the Scholar, the Merchant and the Philanthropist." Evidence of the international interest which always has characterized the American Geographical Society is shown by the "Humboldt Commemoration" contained in the October issue for 1859. Humboldt was an honorary member of the Society and letters from such men as L. Agassiz, James D. Dana, John L. LaConte, and Edward Everett, and addresses by Francis Lieber, Professor Guyot, and George Bancroft show the high appreciation in which Humboldt was held by American scholars. This international interest is still characteristic of the Society, for it has sponsored and published much fine work done by American geographers in foreign countries, and, from time to time, articles from foreign writers appear in its publications. At present this international interest is illustrated specifically by a department devoted to the compilation and publication of the one to a million map and other maps of Hispanic America and to the publication of monographs dealing with selected areas in that vast region. In many ways, therefore, the Society is a point of contact for American and foreign geographical thought. The publications of the Society, past and present, however, as valuable and as distinctive as they are and have been, do not reveal the full

current of American geographic thought. The Society has wisely cultivated the international rather than the American field, and for many strong currents of American geographic thought one must look outside of its publications.[12]

SURVEYS OF LAND AND RESOURCES

Surveys of land areas, with their waters and other resources, have been one of the major expressions of geographic thought in this country. Thus in the first half of last century, as the larger areas of unknown territory yielded to exploration, great interest developed in geographical and topographical surveys. Spectacular events like the war with Mexico and the discovery of gold in California, and great questions like the ever-growing hope for railroad connection with the Pacific coast created a demand for reliable information about the West, most especially the areas west of the hundredth meridian. Mountain passes, water supplies, grazing areas, and timber and mineral resources, for example, became matters of grave import to railway builders, to prospectors, and to the rising tide of settlers. As a result numerous surveys came into being, some under the War Department, some under the Department of the Interior, and some under other agencies. Of these, several were of high importance geographically, including the joint survey of the United States and Mexican boundary in 1854–56, the surveys of possible railway routes to the Pacific in 1853–55 by the War Department, and the geographical and geological surveys of King, Hayden, Wheeler and Powell.[13] All of these and many others have a bearing on the development of geographic thought, but the work of Emory, Wheeler and Powell ranks them high among the immortals in American geography.

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[12] Some of the work of the Society's staff has been published elsewhere.

[13] Emory, Maj. William H., *Report on the United States and Mexican Boundary Survey, Made under the Direction of the Secretary of the Interior, H. P. Ex. Doc. No. 135, 34th Congress, 1st Session,* Washington, 1857, Vol. I; *Reports of Explorations and Surveys, to Ascertain the Most Practical and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, 1853–55, S. Ex. Doc. No. 46, 35th Congress, 2d Session,* Washington, 1855– , 12 vols.; King, Clarence, *Geological Exploration of Fortieth Parallel, 1870–1880*; Hayden, F. V., *United States Geological and Geographical Survey of the Territories, 1867–1879*; Wheeler, Capt. Geo, M., *United States Geographical Surveys West of the One Hundredth Meridian, Engineer Dept., U. S. Army, 1869–1884*; Powell, Maj. J. W., *United States Geographical and Geological Survey of the Rocky Mountain Region, 1874–1879.*

For list of publications of the King, Hayden, Wheeler and Powell surveys see Schmeckebier, L. F., *Catalogue and Index of the Publications of the Hayden, King, Powell and Wheeler Surveys, U. S. G. S., Series G. Miscellaneous, 26, Bull. 222,* Washington, 1904.

DESCRIPTION AND GENERALIZATION

Increasing interest in geographical description and generalization characterized the decade from 1850 to 1860. The earlier writers, particularly the explorers, confined their reports to narratives of their progress and of the conditions from point to point along their route. These narratives introduce the adventuresome spirit of the pioneers but do not give one an idea of the country traversed. Even in the surveys the writers at the outset were content with random observations as they progressed along the route of their season's work. Much of the writing is too sketchy to yield a regional understanding, and certainly it does not evidence the continuity of thought and the massing of evidence which were to come later. In certain of the Wheeler and Powell and Pacific Railway Survey volumes, however, and especially under the spur of such definite assignments as faced Major Emory in the Mexican boundary survey, careful description of the country traversed is introduced.[14] Emory, for example, has a chapter headed "General Description of the Country."[15] In this, among other things, he deals with the suitability of the boundary zone as a divide between two countries and writes graphically and effectively of sand deserts with their storms, of the native vegetation, and the agricultural capacity of the land. Emory also introduces a protest against generalization upon insufficient data when he argues that "Hypothetical geography has proceeded far enough in the United States. In no country has it been carried to such an extent, or been attended with more disastrous consequences. This pernicious system was commenced under the eminent auspices of Baron Humboldt, who, from a few excursions into Mexico, attempted to figure the whole North American continent. . . . On the same kind of unsubstantial information maps of the whole continent have been produced and engraved in the highest style of art, and sent forth to receive the patronage of Congress and the applause of geographical societies at home and abroad, while the substantial contributors to accurate geography have seen their works pilfered and distorted, and themselves overlooked and forgotten."[16] The

[14] Powell, J. W., "Physical Characteristics of the Arid Region," *Report on the Lands of the Arid Region of the United States,* Washington, 1879, pp. 1–24; some of the descriptions of the atlas sheets in Wheeler, Capt. Geo. M., *United States Geographical Surveys West of the One Hundredth Meridian, Vol. I—Geographical Report,* Appendix B; Parke, Lieut. John G., *Report of Explorations for Railroad Routes from San Francisco Bay to Los Angeles, California, West of the Coast Range,* Vol. VII of Reports of Explorations and Surveys to Ascertain the Most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, *Senate Ex. Doc. No. 78, 33d Cong., 2d Session,* Washington, 1857.

[15] Emory, *op. cit.,* Vol. I, Chap. III, pp. 39–52.

[16] *Ibid.,* p. 44.

thought of 1935, I believe, agrees with Major Emory's plea for restraint in generalization. I trust that we are well past the time when a motor trip or a dogsled journey is considered ample preparation for a generalized treatment of an area.

MAPPING PROGRAMS

Geographic thought and initiative have been instrumental in the establishment of most of the great mapping programs in this country. The initiative of Thomas Jefferson in the establishment of the coast survey has been mentioned, and in the work of the King, Hayden, Wheeler, and Powell surveys the geographers were charged with the responsibility of making the base maps. This involved the determination of the geographic coordinates of primary points, the extension of a system of triangulation over the areas in question, and the topographical mapping. As the geographers were charged with the responsibility for the basic pattern of the surveys, they commonly planned the route to be followed by the field parties, and the rate of movement. This dictatorship of route and time occasioned considerable comment from other members of the expeditions. Thus King writes, "Up to 1867, geology was made to act as a sort of camp follower to expeditions whose main object was topographical reconnaissance. . . ."[17] and in the same vein Gilbert states that, "In all the earlier explorations of the Rocky Mountain Region, as well as in much of the more recent survey, the geologist has merely accompanied the geographer and has had no voice in the determination of either the route or the rate of travel."[18] In later years, geologists were placed in charge of independent parties and eventually, in the United States Geological Survey which superseded the earlier surveys, came into such dominance that the geographical work for a time was all but eliminated. Major Powell, however, recognized the basic quality of the geographic contribution, for he writes, "Sound geological research is based on geography. Without a good topographic map geology cannot even be thoroughly studied, and the publication of the results of geological investigation is very imperfect without a good map."[19] Many years later W. M. Davis refers to the matter when he argues that whereas geography now owes much to geology, formerly the debt was in the other direction.[20]

[17] King, Clarence, *First Annual Report of the United States Geological Survey,* Washington, 1880, p. 4.

[18] Gilbert, G. K., *Report on the Geology of the Henry Mountains, United States Geographical and Geological Survey of the Rocky Mountain Region,* Washington, 1877, p. vii.

[19] Powell, J. W., "The Organization and Plan of the United States Geological Survey," *Am. Jour. Sci.,* Vol. XXIX, Jan.–June, 1885, pp. 93–102.

[20] Davis, W. M., "A Retrospect of Geography," these *Annals,* Vol. XXII, Dec., 1932, p. 216.

The maps, drawings, panoramic sketches, engravings and photographs of these geographical and geological surveys are remarkable for their artistic value as well as their scientific merit. The sketches and drawings of selected landscapes which characterize the work of this period not only show better technique than many of the block diagrams of later years, but, being drawings of actual places rather than theoretical diagrams, they have the geographical quality of representing actuality. The importance of the map work of these early surveys is illustrated by the fact that Henry Gannett, who joined the Hayden Survey in 1871, began a career in topographic mapping which eventually led to his being called "the father of American map making." Beginning with reconnaissance maps of wide areas in the Hayden Survey he later, as Chief Geographer of the U. S. Geological Survey developed most of the Survey's methods of map-making.[21] The Wheeler survey, moreover, has to its cedit the invention and introduction of the modified secant conic projection, accomplishing a minimum of distortion in azimuth and distance, and in the conjoining of sheets.[22] American geography has produced other developments of this type, the most notable example in recent years being the interruption of the homolographic projection and the invention of the homolosine projection by J. Paul Goode.[23]

The fine work contained in these early government surveys represents the best rather than the general run of cartographic work in America at this period. In fact, most of the country was unmapped except in the crudest way. In many areas the basic triangulation had been done, but with the exception of some sections of the coast and in New Jersey, this work had not led to maps. Thus, as Gannett points out, "The skeleton had been constructed but it had not been filled out with flesh and blood."[24] In fact, although the years since Gannett wrote have given the skeleton plenty of avoirdupois, geographically speaking it still lacks much of being an Apollo Belvedere.

The greatest program of mapping in the history of the country began shortly after the establishment of the United States Geological Survey. This program initiated the present topographic atlas of the United States and grew logically out of the mapping activities of the geographical and geological surveys which preceded the present Geological Survey. This

[21] Darton, N. H., "Memoir of Henry Gannett," these *Annals*, Vol. XII, 1917, 68–70.

[22] Wheeler, Capt. Geo. M., *op. cit.*, Vol. I, p. 139.

[23] Goode, J. Paul, "The Homolosine Projection: A New Device for Portraying the Earth's Surface Entire," these *Annals*, Vol. XV, 1925, pp. 119–125.

[24] Gannett, Henry, "The Mapping of New York State," *Jour. Am. Geogr. Soc.*, Vol. XXVII, 1895, pp. 21–29.

mapping program got under way in 1882 with the reorganization of the topographic branch and the appointment of Henry Gannett as chief geographer, and apparently goes to the credit of the geographically minded Major Powell rather than to the geologically minded first director of the Survey.[25]

Another example of geographic initiative in a map program is furnished by New York State. Until 1888 no good map of the state was in existence. Such a condition naturally was deplored by geographically minded men and thus in 1875 the American Geographical Society brought the matter to the attention of the state legislature. A bill was passed and work begun. Eight years of triangulation followed, but no map being forthcoming Governor Cleveland vetoed further support. The basic work had been done, however, and shortly after the United States Geological Survey began topographic mapping in the state maps began to appear.

Geographic initiative has found expression in many other map programs. As will be explained subsequently, land classification mapping reached its first development under geographic auspices and certain recent developments in this field are entirely geographical in their origin. In the mapping program of the United States Bureau of Soils, Curtis F. Marbut, a charter member and former president of this Association, exerted a profound influence. In the Land Economic Survey of Michigan professional geographers and geographically minded soil experts functioned from the outset. It will be remembered also that the *One to a Million Map of Hispanic America,* now well on towards completion, is in its conception and execution a strictly geographic undertaking. Another type of map work representing geographic initiative was launched in the Department of Agriculture with the appearance of *Geography of World Agriculture* by Finch and Baker and has been continued in the *Atlas of American Agriculture* and many other publications. The physiographic diagram as developed by A. K. Lobeck and the rapid evolution of the isoplethic map as an instrument in regional delimitation by Wellington D. Jones offer further evidence of geographic contributions to mapping programs.[26]

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[25] *The United States Geological Survey, Its Origin, Development, Organization and Operations, Bull. 227, Series G, Miscellaneous 27,* Washington, 1904, p. 56.

[26] Jones, Wellington D., "Ratios and Isopleth Maps in Regional Investigation of Agricultural Land Occupance," these *Annals,* Vol. XX, 1930, pp. 177–195.

See also the same author's "Present Status and Future Possibilities of Agricultural Land Utilization in Patagonia" in *Pioneer Settlement, American Geographical Society, Special Publication No. 14,* pp. 124–145.

LAND UTILIZATION AND CLASSIFICATION

Interest in the uses of the land, both actual and potential, characterizes the decade from 1870 to 1880. Wheeler, for example, devotes the first of his seven volumes to a "Geographical Report" and in it, among other things, deals with population, industries, communication, irrigation and artesian wells.[27] He brings out the relation of the growth of population to water supply, the percentage of arable land to the total area surveyed, the position of agricultural land on valley floors and plains, the relation of irrigation to the chemical and mechanical quality of the water, the need of drainage in irrigated areas, and the importance of unity of ownership of land and water in irrigated communities. Major Powell, likewise, gave much time and thought to land problems. He presents a plan for "The Land System Needed for the Arid Region" and was active in framing legislation for the wise use of the western lands.[28]

Land classification became a reality in the geographical and geological surveys under Hayden,[29] Wheeler[30] and Powell.[31] As might be expected, their classification differed as to the items segregated, for they worked in somewhat different types of country. All of them, however, segregated agricultural lands, timbered tracts, grazing areas, and wastes or barrens. They present their results in finely executed maps which constitute an illuminating geographic record of the period.

Unfortunately for geography, the momentum in land classification and use gained in the Hayden, Wheeler and Powell surveys did not carry into the United States Geological Survey which in 1879 superseded the earlier surveys. There is no question, however, but that the scientific and congressional sponsors of the new survey intended that the land classification work should continue. A committee of the National Academy of Science, as requested in the sundry civil bill of June 30, 1878, prepared recommendations for the new survey stating, among other things, that in the disposition of the agricultural, mineral, pastoral, timber, desert, and swamp lands, a thorough investigation and classification of the public domain is impera-

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[27] Wheeler, Capt. Geo. M., *op. cit.*, Chap. III, pp. 172–210.

[28] Powell, Maj. J. W., *Lands of the Arid Region of the United States*, Washington, 1879, pp. 27–45.

[29] Hayden, F. V., *op. cit.*, *Geological and Geographical Atlas of Colorado*, 3 pages, 20 maps. Washington, 1876, and "Report on the Arable and Pasture Lands of Colorado," *Tenth Annual Rept.*, Washington, 1878, pp. 313–347.

[30] Wheeler, Capt. Geo. M., *op. cit.*, *Topographical Atlas*, including land classification maps of parts of seven states, and *Geographical Report* (Vol. I), including Chap. V and Appendix B.

[31] Powell, Maj. J. W., *op. cit.*

tively demanded.[32] Furthermore, Clarence King, the original director of the survey, points out that the legislation creating the bureau imposed two special and distinct branches of duty, namely, "1. The classification of the public lands; and 2. The examination of the geological structure and mineral resources."[33] The first of the two duties was not carried out for many years, however. According to King this grew out of uncertainty as to the stipulation in the law creating the Survey. He points out that "the law leaves an uncertainty as to whether or not this classification is intended to be a scientific exposition of the kinds of land included in the national domain . . . or whether it simply is to furnish a basis for disposing of the public lands." In view of the fact that the Land Office had been doing the latter for many decades one sees little reason for the director's uncertainty. Perhaps his views were influenced by his great interest in geology and by the fact that of the four earlier surveys his was the only one which did not include work in land classification. In all fairness to King, it should be understood that appropriations were small and the geological demands heavy. No matter what the cause may have been, the fact remains that although King claims that a careful beginning was made in scientific land classification, the land classification work of the Survey for the most part remained suspended until 1906.[34] As there was little real classification in the General Land Office until Theodore Roosevelt's administration, for a quarter of a century after 1880 relatively little progress was made in land classification.[35]

This generalization about the absence of land classification in the Survey before 1906 is subject to one exception, and an important one. The exception comes from the forest classification work under Henry Gannett in the Division of Geography and Forestry, a division of the Topographic Branch. To this division, organized in 1896 as a division of geography, the Survey consigned all matters connected with general geography, the preparation of secondary maps, and the preparation of papers on geographic and physiographic subjects. To these duties were added in 1897 the examination of

[32] The committee included such famous men as Marsh, Dana, Rogers, Newberry, Trowbridge, Newcomb and Agassiz. See *Centennial Celebration of the United States Coast and Geodetic Survey*, Washington, 1916, pp. 47–48; see also Smith, George Otis, and Others, *The Classification of the Public Lands, U. S. G. S. Bull. 537*, Washington, 1913, pp. 12–13; and Woodruff, G. W., "Classification of the Public Lands," *Annals. Am. Acad. Pol. and Soc. Sci.*, Vol. XXXIII, Jan.–June, 1909, pp. 605–610.

[33] King, Clarence, *First Annual Report U. S. G. S.*, Washington, 1880, p. 5.

[34] Smith, George Otis, and others, *op. cit.*, p. 13.

[35] Conover, Milton, *op. cit.*, pp. 51–52.

forest conditions in the reserves and other wooded areas of the country.[36] The areas under examination were classified as wooded and non-wooded, and the wooded areas examined as to areas suited to lumbering, firewood or other uses. They also defined cutover and burntover areas, estimated the character and quality of the standing timber, and reported on the character of streams in regard to the driving of logs and on the relief in reference to the construction of logging railroads. These examinations, extending over a period of more than seven years, resulted in a coverage of more than 7,400,000 acres and in many important maps and reports. This work, done under one of the foremost geographers of the period, brought high praise from Gifford Pinchot and was the first serious attempt to examine and appraise the forests of the country.[37]

Gannett's examination of the forest reserves led to the preparation of land-classification sheets, using the atlas sheets of the topographic survey as a base. In addition to the forest, cutover and burntover areas, these sheets showed the irrigable and pasture lands. Gannett points out that such work did not originate with the Geological Survey, for the Hayden, Powell, and Wheeler surveys all gave attention to the subject in their reports and maps.[38] In fact, in this work Gannett capitalized his own experience in the Hayden survey, especially his study of land classification in Utah.[39] This land classification work carried on by Gannett and his group at the turn of the century again shows the significance of geographic thought and initiative in land classification and land utilization.[40]

After 1906 the Geological Survey and the General Land Office launched

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[36] *The United States Geological Survey, Bull. 227 cit.*, p. 71.

[37] *Nat. Geogr. Mag.*, Vol. XI, 1900, pp. 369–372.

[38] *The United States Geological Survey, Bull. 227 cit.*, p. 73.

[39] Gannett, Henry, "Report on the Arable and Pasture Lands of Colorado," *Tenth Annual Report of the Geological and Geographical Survey of the Territories*, Washington, 1878, pp. 311–347.

[40] Other types of land classification carried on by the Geological Survey include the classification and evaluation of mineral lands (more actively after 1910) and the investigations of the water resources of the country. Some of the reports from the last named have high geographic quality, as, for example, Williard Johnson's study of "The High Plains and Their Utilization" (*Twenty-First Ann. Rept. U. S. G. S., Pt. IV, Hydrography*, 1901, pp. 609–741). In 1908 a Land Classification Board was organized and in 1912 this board was made a separate branch of the Survey. Valuable work in land utilization and certain types of land classification have been carried on in the Bureau of Agricultural Economics, the Bureau of Chemistry and Soils, and the Bureau of Forestry of the Department of Agriculture. That geographic thought has influenced the development of these programs is shown by the fact that such men as Curtis F. Marbut, O. E. Baker, and H. L. Shantz have been associated with much of it.

cooperative work in land classification. It should be remembered, however, that most of the sheets resulting from this work are simply kept on file and are not given general distribution. One judges that, with the exception of a few government bureaus, the land classification sheets and data largely are unknown and unused. The effect upon the geographic study of land classification and land utilization has been much as would have been true in geology if the geologic maps produced by the Survey in the same period had simply been kept on file in Washington. In view of the fact that, as George Otis Smith wisely declared, "the purpose of land classification, then, is highest utilization," I leave to your imagination what might have been the returns to geographical science and to society had the regional studies in land classification, ably launched in the Hayden, Wheeler and Powell surveys, been continued without interruption to the present time.

EXPLANATORY STUDY OF PHYSICAL FEATURES IN SELECTED REGIONS

The decades from 1880 to 1900 constituted an eventful period for geographical science. Great gains were made and great losses suffered. The outstanding gains came in the explanatory study of the physical features of selected regions, whereas the losses, as has been explained, were in land classification. Some fine regional work had been done in the previous decade, as, for example, Gilbert's justly famous report on the geology of the Henry Mountains, Powell's study of the lands of Utah, and Gannett's report on the arable and pasture lands of Colorado.[41] Following his work on the former, Gilbert had been entrusted by Powell with an investigation of the irrigable lands of the Salt Lake drainage system. The results are incorporated in Powell's report, but from this and other work on the Great Basin Gilbert gained momentum for his classical study of "Lake Bonneville" and for an equally noteworthy study done under his direction, namely, the monograph on "Lake Lahontan" by I. C. Russell.[42] Although these monographs were published by the Geological Survey, their foundations were laid in Major Powell's *Geographical and Geological Survey of the Rocky Mountain Region.*

The interest in the explanatory study of the physical features of regions

[41] Gilbert, G. K., *Report on the Geology of the Henry Mountains, U. S. Geographical and Geological Survey of the Rocky Mountain Region,* Washington, 1877; Powell, J. W., *Report on the Lands of the Arid Region of the United States with a More Detailed Account of the Lands of Utah,* Second Edition, Washington, 1879; Gannett, Henry, "Report on the Arable and Pasture Lands of Colorado," *op. cit.*

[42] Gilbert, G. K., *Lake Bonneville, Monographs of the United States Geological Survey,* Vol. 1, Washington, 1890; Russell, Israel Cook, *Geological History of Lake Lahontan, Monographs of the United States Geological Survey,* Vol. XI, Washington, 1885.

was not confined to the work of the Federal Government; in fact, some of the finest work was done in the state surveys or under other auspices. Geological and natural history surveys had been undertaken by many states and in several of the universities important work in the earth sciences was under way. Men of the scientific stature of Shaler and Davis at Harvard, Chamberlin and Salisbury at Chicago, Russell at Michigan, Tarr at Cornell, found increasing recognition for their work in geographic geology and physical geography. The analytical work of the period is exemplified by the regional studies which appeared in the first volume of monographs published by the National Geographic Society in 1895. Among these Bailey Willis's "The Northern Appalachians," in which one section is devoted to the influence of the Appalachians on settlement, and William Morris Davis's "The Physical Geography of Southern New England" are representative of the work of the period. A foreshadowing of the coming interest in regional delimitation and the technique of classification is afforded by Major Powell's "Physiographic Regions of the United States" in the same volume. Three significant state studies of physical features are, in order of publication, *Physical Features of Missouri* by Curtis F. Marbut,[43] *The Physical Geography of New Jersey* by Rollin D. Salisbury,[44] and *The Physical Geography of New York State* by Ralph S. Tarr.[45] All three are remarkable for careful analysis, clarity of expression, and the Salisbury volume for its cartographic excellence.

WIDENING GEOGRAPHIC INTERESTS AT THE CLOSE OF THE CENTURY

The period from 1880 to 1900 witnessed a decided widening of interest in geographic considerations. The increasing interest betrayed itself in the incorporation of the National Geographic Society in the District of Columbia in 1884 and in the strengthening of the work of the American Geographical Society.[46] The publications of these societies show the trend

[43] Missouri Geol. Surv., Jefferson City, 1896.

[44] Final Report of the State Geologist, Vol. IV, Trenton, 1898.

[45] New York, the Macmillan Co., 1902. This study appeared originally in the *Jour. Am. Geogr. Soc.*, Vols. XXVIII to XXXII.

[46] Apparently the National Geographic Society did not become active until 1888, for its first regular meeting was held on February seventeenth of that year. The society in its certificate of incorporation declares that among other things its objects and business are "to increase and diffuse geographic knowledge" and "to publish a periodical magazine, and other works relating to the science of geography." Such names as Hubbard, Dutton, Powell, Gannett, and Greeley are signed to the certificate of incorporation and its early programs and publications carry out the stated objectives in effective fashion. The breadth of interest of the society is shown by its roster of officers. There were five vice-presidents representing respectively Geography of the Land, Geography of the Sea, Geography of the Air, Geography of Life, and

of geographic thought in the last decade of the century. Exploration dominated the interest of both societies, but surveys and mapping, genesis of land form, climate and weather, description of areas, particularly of areas in foreign lands, also were common interests. Both organizations reviewed the developments of geographical science in foreign countries, and show that the American geographers of the period were not as ignorant of geographic developments in Europe as some of our present-day writers would have us believe.

Although many men made contributions to geography in the last two decades of the century, leadership in the philosophy of geography and in the projection of geographic thought in America was attained by William Morris Davis. His contributions are familiar ground to all of us. His professorship at Harvard, his meteorological work in South America, his connection with the Geological Survey, his association with Shaler, all contributed to his standing, but his leadership depended primarily upon his ability to see the scope of the science, to define a working point of view, and to dig deeply into the phases of the science on which his own work centered. Like most scientists, he placed his own creative work in the center of the picture and thus for many years the explanatory description of land forms occupied the center of the geographic stage. During the nineties he perfected his theory of the physiographic cycle and his theories and systematic work attained international recognition. As early as 1891, Shaler and Davis had attracted students destined to play important rôles in geography. In 1891–2, for example, the students group included A. P. Brigham, R. S. Tarr, L. G. Westgate, A. H. Brooks, C. F. Marbut, R. DeC. Ward, and R. E. Dodge.[47] The development of such training and the appearance of such students heralded a new era in American geography.

The turn of the century found several important currents of geographic thought under way. As these currents claimed the interest of scholars of strong convictions and large ability, they led to developments of prodigious significance to geographic science. The year 1903 witnessed five such developments, and thus rates as one of the highly significant years in American geography. In that year occurred the initial move in the founding of the Association of American Geographers, the creation of the first department of geography in an American university, the publication of two notable books in the field of anthropogeography, the appearance of the first article of major dimensions in economic geography, and important con-

Geography of Art. Each vice-president was supposed to report each year on the progress in his domain, and, what is more remarkable, for a few years they did (*The National Geographic Magazine*, Vols. I and II).

[47] Dodge, R. E., "Albert Perry Brigham," these *Annals*, Vol. XX, 1930, p. 56.

tributions in political geography. As our interest focuses on the chain of thought which the event represents, rather than the event itself, we shall look forward from the event of 1903 to the development of each of these five chains of thought.

EXCHANGE OF GEOGRAPHIC THOUGHT

Shortly after the turn of the century Professor William Morris Davis became convinced that the development of the science of geography would be facilitated by a scientific organization dedicated to the promotion and discussion of geographic thought. Consequently, at the St. Louis meeting of the American Association for the Advancement of Science in 1903, Professor Davis, vice-president and chairman of Section E, chose for his topic "Geography in the United States." He called attention to the fact that although Section E was named "Geology and Geography" no vice-president of the section had given an address on a geographic topic. As a feature of his address he proposed the establishment of a geographical association "with criteria of expert training and ample publication as a basis for membership." The proposal aroused the interest of a number present and as a result some time in 1904 a "parlor conference," as Professor Brigham called it, was held in Washington. Of this conference Professor Brigham wrote the speaker in 1928, "I do remember something of that conference—that I found there a group of masters in earth science, and that a fellowship and an interest in the new project pervaded the meeting, which boded well for the future of geography in America." Time has justified the ambition of Professor Davis and the other founders. The Association has retained its devotion to science, has succeeded in excluding propaganda, politics, hysteria, and other elements which have hindered the work of many scientific organizations. From its inception it has been the principal frame of reference for geographic thought in America.

What the founders of the Association thought about is clearly evidenced by the program of the first annual meeting held at the University of Pennsylvania on December 29, 1904. This program contained 20 titles, of which 14 dealt with land forms, two with plant ecology, and one each with animal ecology, cartography, and historical geography. This overwhelming interest in land forms continued to be the center of thought for several years, and, until the present, has remained one of the strong, virile phases of geographic effort in this country. Even here, however, there has been a change. Under the inspiration of Davis the interest centered in the genesis of land forms, especially in questions involving Davis's "cycle of landform evolution."[48] Gradually there arose the perplexing question as to whether

[48] Johnson, Douglas, "The Geographic Prospect," these *Annals*, Vol. XIX, 1929, p. 208.

or not the study of the genesis of land forms lies within or without the scope of geographical science. Whatever the opinion may be on that question, one can not doubt that there still is great interest in the geographical study of land forms. An important change of emphasis was initiated when at an early meeting of the Association N. M. Fenneman led a round table discussion on "Physiographic Divisions of the United States." The novel idea that land forms could be classified regionally met with no little opposition and many predicted that it could not be done. It was done, however, and in soundness of concept and skill in applying criteria stands as a landmark in our science.[49] At present the interest in land forms has reached another stage. Classification in terms of the inherent characteristics of land forms is under way, and intensive examinations of the effect of use on surface conditions promise to yield highly significant results.[50]

CULTIVATION OF GEOGRAPHIC THOUGHT IN THE UNIVERSITIES

From 1900 onward the universities have played an ever increasing rôle in the evolution of geographic thought. As has been stated, the scholarly work of Shaler and Davis at Harvard won widespread recognition. Brigham at Colgate, Dodge at Teachers College, Marbut at Missouri, Dryer in Indiana, and others elsewhere were carrying forward creative work in some phase of the science. At California the work in physiography had been segregated into a separate department. In 1901 and again in 1903 the University of Pennsylvania granted the degree of Doctor of Philosophy to men destined to make their marks in geography.[51] In 1903 Cornell University announced a summer school of geology and geography with a staff which included such names as Tarr, Brigham, Charles McMurry, and Whitbeck.[52] These and other developments of the time evidence a growing interest in geography. This interest reached a new stage, however, when the University of Chicago in 1902–03 created a separate department of geography.

The new department at Chicago was launched under especially favorable local conditions. The University itself was but ten years old, and there were no prejudices against new ideas and new lines of work. The new department grew logically and naturally out of the close association of Professors T. C. Chamberlin and Rollin D. Salisbury in the department of

[49] Fenneman, Nevin M., "Physiographic Divisions of the United States," these *Annals*, Vol. VI, 1917, pp. 19–98.

[50] Sauer, Carl O., "Land Resources and Land Use in Relation to Public Policy," *Report of the Science Advisory Board, July 31, 1933, to Sept. 1, 1934*, Washington, 1934, Appendix 9, pp. 163–192.

[51] To J. Paul Goode in 1901 and J. Russell Smith in 1903.

[52] *Bull. Am. Geogr. Soc.*, Vol. 35, 1903, pp. 177–179.

geology. Chamberlin had resigned the presidency of the University of Wisconsin to establish the department of geology at Chicago and had brought Salisbury with him as professor of geographic geology. The latter had studied at Heidelberg in 1887 and was familiar with the high standing of geography in Germany. The two men were known for their ability in research and their scientific standing was beyond question even in the galaxy of brilliant scientists at Chicago at that time. Professor Salisbury, moreover, for six years had been Dean of the Ogden Graduate School of Science—a scientific post of first rank in the University and in the country. Under the leadership of a man of such local prestige the new department commanded respect from the outset.

Work in certain other departments of the University favored the new venture. For some time courses with some geographic qualities had been offered in physical geography and meteorology in the department of geology, in geographic botany by the brilliant H. C. Cowles in the department of botany, in zoogeography in the department of zoology, and in commercial geography in the department of political economy. The immediate aim of the new department as announced was to occupy the ground intermediate between geology and climatology on the one hand, and history, sociology, political economy, and biology in the other.[53] The appointment of Dr. J. Paul Goode in 1903 introduced work in economic and regional geography and from time to time Miss Ellen C. Semple offered anthropogeography. From the outset Professor Salisbury emphasized the regional approach for geographic investigation. This was in harmony with the emphasis in his own research, for his published bibliography contains more than a dozen titles written from a regional basis.[54] The regional emphasis appeared also in the research of graduate students in the department and in the fundamental organization of the research and teaching staff. Professor Salisbury's demonstration of the utility of geography at the university level helped to stimulate interest in the science and thus was a factor in the introduction of geography in other colleges and universities.

ANTHROPOGEOGRAPHY

The turn of the century found a growing interest in the human aspects, of the science. Evidence is contained in the publications of the geographic societies and in the work of Shaler, Cyrus C. Adams, Brigham, Gannett, Semple, and others. The year 1903 again comes into the picture with the

[53] "Geography in the University of Chicago," *Bull. Am. Geogr. Soc.*, Vol. XXXV, 1903, pp. 200–208.

[54] Chamberlin, R. T., "Memorial of Rollin D. Salisbury," *Bull. Geol. Soc. Am.*, Vol. 42, 1931, pp. 126–138.

publication of *American History and Its Geographic Conditions* by Ellen Churchill Semple and *Geographic Influences in American History* by Albert Perry Brigham. The Semple and Brigham volumes not only brought anthropogeography definitely to the attention of American geographers, but won wide public interest. In the enthusiasm of the moment and under the spell of a stimulating thesis, many writers, some of whom were poorly prepared for this difficult type of work, entered the field. Over-enthusiastic claims were made and some careless work appeared. Brigham later called attention to the difficulties inherent in this type of inquiry and pleaded for careful work and detailed investigations.[55] Systematic anthropogeography was emphasized by Ellsworth Huntington, but both Huntington and Brigham diverted much of their energies to other types of writing. It remained for Miss Semple, by years of persistent effort, to bring the philosophy of anthropogeography to its richest development. Her whole productive life was devoted to this type of geographical thought, and her numerous publications give ample opportunity to judge its merits. No one else in American geography has more rationally and completely illuminated a field of geographical inquiry.[56]

HISTORICAL GEOGRAPHY OF THE UNITED STATES

Work in historical geography of the United States was introduced into university circles in the summer of 1904. In that year, H. H. Barrows first offered his justly famous course, called originally "Influences of Geography on American History." In the decade or more following 1903, when geography needed to justify its inclusion in the university curriculum, this course and associated offerings at the graduate level showed how to introduce the scientific method into human geography. Because of their relation to the training and productive output of graduate students who subsequently introduced geography into different sections of the country, probably no other group of courses has had a greater bearing on the standards of geographic investigation in America. As time went on, Barrows greatly modified his point of view and his original course was changed to its present title, "Historical Geography of the United States." This change of title marks a fundamental change of concept on the part of Barrows and many others. Gradually Barrows had come to realize the "danger of assigning to the environmental factors a determinative influence which they

[55] Brigham, Albert Perry, "Problems of Geographical Influence," these *Annals*, Vol. V, 1915, pp. 3–25. For critical evaluations of Brigham's work in this field by R. E. Dodge and Whitbeck, see these *Annals*, Vol. XX, 1930, pp. 58–60 and 78–80.

[56] For Miss Semple's bibliography and the stages in the evolution of her work see these *Annals*, Vol. XXIII, 1933, pp. 238–240.

do not exert," and found it wise to view the geographical problem "in general from the standpoint of man's adjustment to environment, rather than from that of environmental influence."[57] This thesis, likewise, has had an important bearing on the evolution of geographic thought in this country.

ECONOMIC GEOGRAPHY

Interest in the field of inquiry commonly designated as economic geography has been one of the persistent currents of geographic thought. As has been stated previously, the articles in the ten issues of the *Journal of the American Geographical and Statistical Society* for 1859, by their titles and content, betray an active interest in economic activities and natural resources. The early geographical and geological surveys, moreover, offer abundant evidence that Hayden, Wheeler, Powell, Gannett, and others had much in common with the economic geographers of the present. As far as the geographical journals show, however, the first article which by its title is ascribed to the field of economic geography appeared in 1888. The credit this time goes to the Navy, for the article was written by a naval officer.[58] The year 1903 again comes into the picture, however, for in that year appeared an article by J. Russell Smith under the title "The Economic Geography of the Argentine Republic."[59] In this study Smith maps the country in terms of resources and industries and in its organization, documentation and content the article sets a high standard for the aspect of the science which it heralded. The great awakening of interest in the field came, however, eight years later, with the publication of Smith's *Industrial and Commercial Geography*. This notable volume provided an organization and a content for courses at the college level and stimulated much

[57] Barrows, H. H., "Geography as Human Ecology," these *Annals*, Vol. XIII, 1922, pp. 1–14.

[58] Stockton, Lieut. Commander Charles H., "The Commercial Geography of the American Inter-Oceanic Canal," *Jour. Am. Geogr. Soc.*, Vol. XX, 1888, pp. 75–93.

In 1891 John N. Tilden published *A Commercial Geography*—a book surprisingly forward looking in organization and content. The interest of Cyrus C. Adams in the subject is shown by a number of titles in the Journal of the American Geographical Society of which he was editor and by his *Commercial Geography* published in 1901. In the same year appeared the first use of the term economic geography in the title of an article in an American geographical journal. Credit, interestingly enough, goes to Ellen Churchill Semple ("Louisville: A Study in Economic Geography," *Jour. School Geog.*, Vol. IV, Dec., 1900, pp. 361–370). That year also witnessed a philosophical treatment of the field of economic geography in a double article by L. M. Keasbey ("The Study of Economic Geography," *Pol. Sci. Quart.*, Vol. 16, 1901, pp. 79–95, and "The Principles of Economic Geography," *ibid.*, pp. 476–485).

[59] *Bull. Am. Geogr. Soc.*, Vol. 35, 1903, pp. 130–143.

thinking and research in the field. Seldom has a textbook had wider influence.

Research in economic geography, however, was slow in coming. Several texts appeared, but the basic scientific advances of a field of inquiry commonly are not made in connection with textbook writing. The truest index of interest in prosecuting geographic inquiry in economic geography, therefore, comes from the articles and monographs which have appeared in the field. Before 1921, with the exception of *Geography of World Agriculture* and some other striking examples, the number of authoritative monographs and magazine articles was relatively small.[60] The World War gave research opportunities and practical experience to a score or more of economic geographers and following the war the number of workers in the field increased rapidly. Publication, however, did not keep pace. Men prominent in other phases of geography were unable to detect scientific qualities in much of the output, and the established journals looked askance at much of the new type of work. Our *Annals,* however, with its customary policy of freedom of expression, gave space to some studies and then in 1924 Clark University launched *Economic Geography.* That journal has created a new literature, has stimulated new thought and new types of research, and through its willingness to give space to previously unknown authors and to experimental output has played and is playing a unique rôle in American geographic thought.

If I judge present opinion correctly, geographers agree that economic geography has not attained maturity. Apparently it is thought that much of the work thus far has been in the empirical or fact gathering stage. In science that certainly is a characteristic of youth, although science at any stage is a poor thing without facts and is always searching for more facts. It is thought also that there have been insufficient and in many instances inexpert classifications of the facts gathered. More has been accomplished in this systematic stage, however, than many realize. Classification in economic geography presents extraordinary difficulties because it involves both the phenomena of nature and the phenomena of economic activities. In any given area these two sets of phenomena are reciprocally related, in form, in pattern, and in function. This calls for classification of (1) the phenomena of nature, (2) the phenomena of culture, and (3) the areal expression

[60] Representative studies of the period are: Whitbeck, R. H., "A Geographical Study of Nova Scotia," *Bull. Am. Geogr. Soc.,* Vol. 46, 1914, pp. 413–19; Tower, W. S., "The Pampa of Argentina," *Geogr. Rev.,* Vol. V, No. 4, 1918, pp. 293–315, and the same author's "Western Canada and the Pacific," *Geogr. Rev.,* Vol. IV, No. 4, 1917, pp. 284–296; Sauer, Carl O., "The Economic Problem of the Ozark Highland," *The Scientific Monthly,* Sept., 1920, pp. 215–227.

of the reciprocal relation of the two sets of phenomena. We are well along in the first two classifications but as yet have not much to our credit in the third.

POLITICAL GEOGRAPHY

For most American geographers, political geography is like Mark Twain's statement about the weather. Everyone talks about it, but no one does anything about it. Fortunately, there are some striking exceptions which not only prove the rule, but prove the scientific qualities and social values of political geography. The students of this field of inquiry, I have no doubt, would be the first to admit that much work will be needed before the pay dirt is exhausted.[61]

The United States has been confronted with problems in political geography since the formation of the Union. Judging by the literature some of these fall into the category of the evolution of political areas. Thomas Jefferson with his purchase of Louisiana displayed the political-geographic mind, for he sensed the potentialities of the regions included in the purchase. Another group of problems comes under the head of the demarcation of political boundaries. Major Emory, for example, realized the geographic quality of his work on the United States-Mexican boundary when he wrote, "In this respect it is fortunate that two nations, which differ so much in laws, religion, customs, and physical wants, should be separated by lines, marking great features in physical geography. The boundary is embraced in the zone separating the tropical from the temperate and more northerly regions."[62] In America these two types of problems, namely, evolution of political areas and the demarcation of political boundaries, long have been considered appropriate questions for geographic inquiry. This is evidenced by the allocations in the United States Geological Survey of such studies to the chief geographer in the early eighties. The results of his studies are embodied in a series of carefully prepared bulletins.[63] I. C. Russell, writing in 1903, also deals with the boundary question in his "Geography and International Boundaries"[64] and devotes a chapter to it

[61] For an illuminating presentation of the evolution and status of political geography in America and abroad see Hartshorne, Richard, "Recent Developments in Political Geography," *Am. Pol. Sci. Rev.*, Vol. XXIX, Nos. 5 and 6, Oct. and Dec., 1935, pp. 785–804 and 943–966.

[62] Emory, Maj. William H., *op. cit.*, p. 39.

[63] Gannett, Henry, *Boundaries of the United States and of the Several States and Territories, U. S. G. S., Bull. 226, Series F, Geography, 37*, 1904, Third Edition; first edition appeared as *Bull. No. 13*, 1885, second edition as *Bull. No. 171*, 1900.

[64] Russell, I. C., "Geography and International Boundaries," *Bull. Am. Geogr. Soc.*, Vol. 35, 1903, pp. 147–159.

in his volume on North America.[65] Thus the year 1903 again comes into the picture, emphasizing the several strong currents of geographic thought at that time.

Another type of problem in political geography may be thought of as the geography of political controversy. In some cases the settlement of controversies over state boundaries has called for geographical investigations and thereby greatly stimulated geographic thought. Striking examples of such expert work on the part of geographers is furnished by the work of Bowman and Cowles on the Red River boundary dispute between Texas and Oklahoma and by the work of Martin in connection with the dispute between Michigan and Wisconsin over the boundary of the northern peninsula of Michigan.[66]

The World War provided the greatest opportunity yet to confront workers in political geography. A group of geographers with headquarters at the American Geographical Society served prominently on the commission which prepared for American participation in peace negotiations and later were advisors at the conference in Paris. These experiences provided invaluable materials and stimulated thought and analysis along many lines. Following the War Dr. Isaiah Bowman, the executive of the group, gave us a study of the problems and scope of political geography.[67] This much read and quoted volume clarified and systematized materials and concepts and thereby provided a basis for further research in the field.

In recent years thought in political geography in this country has trended to investigations of carefully defined problems, employing modern methods and techniques. A recent example has won high praise both from geographers and non-geographers and shows the values which accrue from careful work properly organized and adequately financed.[68] The trend of emphasis in this field is well illustrated by a series of articles by Derwent Whittlesey.[69] The establishment of a geographic section in the Department

[65] *North America,* New York, 1904, pp. 408–425.

[66] Bowman, Isaiah, "An American Boundary Dispute," *Geogr. Rev.,* Vol. XIII, 1923, pp. 161–189; Martin, Lawrence, "The Michigan-Wisconsin Boundary Case in the Supreme Court of the United States, 1923–26," these *Annals,* Vol. XX, 1930, pp. 105–163.

[67] Bowman, Isaiah, *The New World, Problems in Political Geography,* Yonkers-on-Hudson, New York, 1921, 1924, 1928.

[68] Hartshorne, Richard, "Geographic and Political Boundaries in Upper Silesia," these *Annals,* Vol. XXIII, 1933, pp. 195–228.

[69] Whittlesey, D. S., "Geographic Factors in the Relation of the United States and Cuba," *Geogr. Rev.,* Vol. 12, 1922, pp. 241–256; "Trans-Pyrenean Spain: The Val D'Aran," *Scot. Geogr. Mag.,* Vol. 49, 1933, pp. 217–228; "Andorra's Autonomy," *Jour. Mod. Hist.,* Vol. 6, 1934, pp. 147–155; and "The Impress of Effective Central Authority upon Landscape," these *Annals,* Vol. XXV, 1935, pp. 85–97.

of State not only places geography in a position to serve, but should have a definite bearing on the evolution of this phase of geographic thought.[70] Although relatively few American geographers are working or are prepared to work in this field, I believe one can predict marked progress in political geography in the coming decades.

OTHER FIELDS OF INTEREST

The limitation of time tonight does not permit the presentation of all of the currents of geographic thought which have occupied the attention of American geographers. Four, however—ecology, population, educational geography, and weather and climate—must be mentioned specifically even though they are not discussed in detail. Interest in plant and animal ecology and geographic botany displayed itself in early programs of the Association and our membership contains the names of many men who have made basic contributions in ecology. Several of these men figured prominently in the founding of the Ecological Society of America in 1916 and three of them, V. E. Shelford, H. C. Cowles and C. C. Adams, have served as president of the Ecological Society. The study of the distribution of population was brought into the open by Mark Jefferson in the early years of the century and subsequently he and many others have contributed to this sphere of geographic interest. Since Richard E. Dodge, then at Teachers College, launched the *Journal of School Geography* in 1897[71] great progress has been made in educational geography. This important field, now in the competent hands of the National Council of Geography Teachers,[72] has commanded the attention of many American geographers.

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[70] See Boggs, S. W., "Boundary Functions and the Principles of Boundary-Making," Abstract, these *Annals*, Vol. XXII, 1932, p. 48. Printed in full in *Press Release*, U. S. Dept. of State, Jan. 2, 1932.

[71] The present *Journal of Geography* represents a combination of the *Journal of School Geography*, Vols. I to V, and the *Bulletin of the American Bureau of Geography*, Vols. I and II. The latter was directed and edited by Edward M. Lehnerts, of the State Normal School, Winona, Minnesota.

[72] The National Council was first visualized by R. H. Whitbeck and George J. Miller and was organized in 1914. Since then the Council has won the respect of the geographic fraternity and the educational world (see Miller, George J., "Letter to State Directors of the National Council of Geography Teachers," *Jour. Geog.*, Vol. 15, 1917, p. 321). The development of thought in educational geography may be traced by examining in chronological order the numerous textbooks by American geographers, by the volumes of the *Journal of Geography*, official publication of the National Council, and by some of the chapters in "The Teaching of Geography," *Thirty-Second Yearbook of the National Society for the Study of Education*, Bloomington, Illinois, 1933. See also a study of the evolution of geography as a high-school subject by Alice Foster in *Education* for Jan., 1935.

Interest in meteorology and climatology has been characteristic of American geography for many years. The first steps to gather meteorological data were made in the Land Office in 1817 through observations taken at the various land offices. This was followed in 1819 by observations at Army posts, and subsequently by several other organizations before the National Weather Service was set up under the direction of the Signal Service of the Army in 1870.[73] From the outset, however, the highly technical work was under the direction of Cleveland Abbe, an early member of the Association. Subsequently, meteorology obtained scientific standing in part through the work of William Morris Davis, Alexander McAdie, O. L. Fassig, Charles F. Marvin, Robert DeC. Ward, Charles F. Brooks, Joseph B. Kincer, Stephen S. Visher, and other members of this Association. After the turn of the century Ward and others emphasized investigations in climatology and in the relation of climate to man. Ellsworth Huntington, beginning about 1910, advanced his challenging theories and hypotheses as to civilization and climate and as to probable changes of climate in geological and historical times. As in the case of the Ecological Society, members of this Association were identified with the establishment of the Meteorological Society of America in 1919. In recent years classification of climates and the study of individual climatic regions has occupied the attention of several American geographers. Recently, also, William H. Hobbs and other members have been identified with the study of polar weather and climate and with the relation of polar conditions to middle latitude climate. From a cursory survey of the vast literature in these fields of inquiry, one hazards the opinion that meteorology by its great recent theoretical and statistical advances is moving out of the geographic domain, whereas climatology, through work in classification of climates and regional study of climate, is becoming increasingly geographic in character.

DEFINITION AND DELIMITATION

Since Professor Davis's historic address of 1903, American geographers have delved deeply into the philosophical aspects of the science. Davis himself, both before and after 1903, led discussions which focused on the definition and delimitation of the field of geography. In characteristic fashion he modified his views as time went on, gradually eliminating certain geological and other considerations which earlier he had included. He thought of geography as being divided into two components of equal rank,

[73] Weber, G. A., *The Weather Bureau, Institute for Government Research, Service Monographs of the United States Government, No. 9*, New York, 1922, pp. 2–4.

namely, physiography and ontography.[74] His own work was in the first of these divisions, and Douglas Johnson understands that Professor Davis came to the conclusion that most of his writings were not strictly geographic in character.[75] That question, however, is of small import, for time is deciding it in unmistakable fashion. The fact remains that Davis profoundly influenced geographic thought and did much to define and delimit its field.

In the decade following the founding of the Association, certain concepts as to the field of geography gained rather general acceptance. This is revealed by a symposium conducted by George B. Roorbach in 1914 on "The Trend of Modern Geography."[76] On the basis of the replies to a questionnaire sent to the leading geographers of the country Roorbach concluded that "there is nearly unanimous agreement as to what geography is" and that according to the opinion of 1914 "geography concerns itself with the study of the relationship between earth and life, particularly human life." He also notes "considerable difference of opinion as to just what lines of investigation should be followed," and "almost general agreement that the aim of geographic work of whatever kind is to establish the facts of, and deduce the principles underlying, this relationship between the physical earth and its inhabiting organisms." This general agreement that geography deals with the earth and man holds to the present day, but of what geography does and does not do with earth and man there is at present a healthy state of disagreement.

Since 1914 there have been numerous pronouncements of the nature and scope of geography. We have had geography defined as the influence of natural environment on man, as the relation of human activities to the natural environment, as the interrelation of man and environment, as the science which deals with "the areal relation,"[77] as the science of Human Ecology,[78] as "Morphology of Landscape,"[79] and as the occupance and use of area. As these definitions are familiar ground to all of you, I shall be content with the assertion that whatever their differences may be, they

[74] Davis, William Morris, "An Inductive Study of the Content of Geography," *Bull. Am. Geogr. Soc.*, Vol. 38, 1906, pp. 67–84.

[75] Johnson, Douglas, *op. cit.*, p. 209.

[76] *Bull. Am. Geogr. Soc.*, Vol. 46, 1914, pp. 801–816.

[77] Fenneman, N. M., "The Circumference of Geography," these *Annals*, Vol. IX, 1919, pp. 3–11.

[78] Barrows, H. H., "Geography as Human Ecology," these *Annals*, Vol. XIII, 1923, pp. 1–14.

[79] Sauer, Carl O., "The Morphology of Landscape," *Univ. Calif. Pubns. Geogr.*, 1925, Vol. II, No. 2. See also his "Recent Developments in Cultural Geography," in *Recent Developments in the Social Sciences*, Philadelphia, 1927, Chap. IV, pp. 154–212.

agree on one important issue, namely, the vital quality of the regional idea in the science. Fenneman, for example, argues that "the one thing that is first, last, and always geography and nothing else, is the study of areas in their compositeness or complexity, that is, *regional geography.*" Barrows writes, "We come now to regional geography, properly recognized as the culminating branch of the science because it involves facts and principles from all divisions and subdivisions of systematic geography." Sauer in his turn makes regional geography the center of interest, for he states, "Under this unitary view the final goal of all geography is regional geography." "Occupance and use of area," moreover, certainly has a regional connotation. At both the 1933 and 1934 meetings of this organization one session was devoted to a conference on regions,[80] and nearly every American geographer in his arguments or by his work has emphasized an interest in the study of the regions which make up the Earth. That we entertain varying points of view as to how to study regions should make for advances in our science.

PRESENT GEOGRAPHIC THOUGHT

Geographic thought at present, if I judge it correctly, has two centers of interest. The first is philosophical and scientific in motivation and calls for intensive study of areal or regional units of varying dimensions. It involves the recognition, mapping, classification, interpretation and comparison of unit areas. The second is social and practical in character and grows out of an active interest in social policies and problems, more particularly in the wise utilization of land and other natural resources. The successful cultivation of either of these centers of interest necessitates a vigorous stand against careless observation, loose thinking, hasty generalization and fragmentary explanation.

As I see it, these two centers of geographic interest are complementary. The explanatory description, if I may use that hackneyed phrase, of unit areas inevitably leads to a consideration of the uses to which we put our land and other resources. Conversely, many problems connected with the use of land and resources can not be understood, much less solved, unless and until they are properly placed in their areal setting.

This close association of geographic science and geographic application is traditional in American geography. As Bowman puts it, "The great epic of America is the conquest of the land."[81] From the outset geography

[80] "Conventionalizing Geographic Investigation and Presentation," these *Annals*, Vol. XXIV, 1934, pp. 77–122; "A Conference on Regions," *ibid.*, Vol. XXV, 1935, pp. 121–174.

[81] Bowman, Isaiah, *Geography in Relation to the Social Sciences*, New York, 1934, p. 221.

has participated in this conquest, leading the way at some junctures, profiting greatly from following leadership at others. Geographical science thus has had at its disposal a laboratory of continental dimensions. Out of it has come our technique, our methods of analysis and synthesis, and our great contributions to geographic science and philosophy. There never was a time, however, when that laboratory invited our scientific attention more than it does today. Contemporary society, in trying to plan for the future, is taking stock of its human and its natural resources. In this stock-taking and in certain aspects of the planning, geography has a part.

Interest in planning for the classification and use of the land and other natural resources is not new to our science; in fact, it is one of the most persistent interests in American geography. As we have seen, geographers played a part in preparing the public domain for settlement at the beginning of our government. Powell, Wheeler, and Hayden in their surveys of the arid regions made many recommendations as to use, and, as has been stated, in 1878 Powell prepared and advocated a plan for a land system for the western territories.[82] Theodore Roosevelt is known for his promotion of the conservation movement, but it may not be known to all of you that he was a member of this Association. During the World War geographers showed their mettle in many planning enterprises, as, for example, in the Division of Planning and Statistics of the Shipping Board and in a similar division of the War Trade Board.[83] Geographers contributed to the establishment and subsequent activities of the Michigan Land Economic Survey, and in Wisconsin a geographer acted as advisor to the State Planning Board. Marbut, Shantz, Baker and others long have demonstrated the utility of geographical thinking and planning in the field of agriculture. Hugh H. Bennett planned and has administered the work of the Soil Conservation Service. Isaiah Bowman developed the idea of planning in pioneer areas and the resulting publications bid fair to be of international service.[84] He also was a member of the Science Advisory Board ap-

[82] Of Powell's work in land classification Henry Gannett wrote, "The Powell survey published a land-classification map of Utah, and a volume entitled 'Lands of the Arid Regions.' This book is a classic on the subject, and formed the basis upon which the entire system, not only of land classification, but of irrigation, is founded." See "The United States Geological Survey," *Bull. 227, cit.*, p. 73.

[83] W. S. Tower, V. C. Finch, George R. Roorbach, William H. Haas, and Charles C. Colby in the former, H. H. Barrows, J. Russell Smith, R. H. Whitbeck, N. A. Bengtson and others in the latter.

[84] Bowman, Isaiah, *The Pioneer Fringe, American Geographical Society Special Publication No. 13,* New York, 1931; "Planning in Pioneer Settlement," these *Annals,* Vol. XXII, 1932, pp. 93–107; *Pioneer Settlement, American Geographical Society Special Publication No. 14,* New York, 1932.

pointed by President Roosevelt July 31, 1933. H. H. Barrows served as a member of the Mississippi Valley Committee, whose report is one of the outstanding documents in the planning field.[85] Professor Barrows also was a member of the Water Planning Committee of the National Resources Board[86] and is continuing as a member of the Water Resources Committee of the National Resources Committee. Since August, 1934, moreover, there has been an extremely active geographic section in the Land Planning and Housing Division of the Tennessee Valley Authority. The foregoing statement by no means exhausts the list, but does show some of the ways in which geography has functioned in planning activities. Other recent developments are described by W. L. G. Joerg in his study of geography and national planning.[87]

TYPES OF PLANNING

Experience is showing that there are two types of planning, specific and general. Specific planning deals with special questions, such as crop rotations, highway construction, county administration, or soil erosion. In most cases the plans are made and executed by professionally trained and experienced men. In this category, therefore, goes agricultural planning, forestry planning, engineering planning, and all of the applied sciences. In this type of planning the basic sciences make their contribution through the introduction of their technique, their methods, or their findings in the solution of particular problems.

Agriculture, for example, has its chemists, its economists, its soil scientists, each group contributing to the special task of the agency of which it is a part. In this connection, I am convinced that agriculture might well have drawn on the sciences even more than it has. Each science has had to battle its way into service, whereas more forward looking agricultural leadership would have been only too eager to call the sciences into service. If that had been done, our numerous agricultural organizations and institutions might have been of much greater service in our periods of emergency than they have.

General or composite planning is of a different nature. Its allegiance is to the whole rather than to the parts. The welfare of all citizens is the

[85] *Report of the Mississippi Valley Committee of the Public Works Administration*, Washington, 1934. Of this report Stuart Chase wrote in the *New Republic* for March 27, 1935, "This is the best report I have ever seen in any language on the intelligent use of land, water and resources for the enjoyment of mankind."

[86] See "Report of the Water Planning Committee," *National Resources Board, A Report on National Planning and Public Works . . .*, Washington, 1934, pp. 253–360.

[87] *Geogr. Rev.*, Vol. XXV, 1935, pp. 177–208.

issue, rather than that of a particular class. Composite planning deals with the interplay of all the cultural elements, and thus is social planning, using social in its broadest sense. Composite planning also deals with the occupance pattern—that is, with the cultural and natural patterns taken together. This is land planning. In this connection it is well to note that some professional planners have thought of the combined cultural and natural patterns (or landscapes) as the physical environment of society. This use of the term "physical environment" may seem odd to geographers, but it is as logical as our own definition. Land planning—that is, composite planning for the occupance pattern—is as much and no more concerned with one part or phase of the occupance pattern than it is with any other part or phase. It is concerned with all elements in the regional pattern, more especially with their association than with their individuality. It is under this concept that geography takes an important place, for it is the only science dealing with the composite pattern of occupance.

PHASES OF THE PLANNING PROCESS

If my claim is true—namely, that geography has a distinctive contribution in the planning process, particularly in the land planning process—the question arises as to just what is the planning process, and just what is geography's contribution to it. I can answer that most concretely in terms of the four phases of the process: (1) Survey and Classification, (2) Appraisal, (3) Design, and (4) Effectuation—all these, it should be understood, in terms of the occupance pattern.[88]

The survey and classification phase of land planning calls for a critical examination of the occupance pattern as it is today. For this work, the topographic and other customary maps and the census and other statistical materials are useful, but they do not deal with all of the features and conditions which in association make up the occupance pattern. Such maps and materials, moreover, are not sufficiently detailed, for as McMurry has pointed out, "as soon as land planning work leaves the theoretical plane, and the problems assume practical application minute detail is essential." Land planning requires an analysis in map and other forms which distinguishes the component elements in any part of the occupance pattern separately or in their relation to the whole. Fortunately, two recent advances in technique make this practical. Aerial mosaics, the great contribution of air photography to mapping, provide the base. Site analyses, recorded in the fractional code, an analytical technique developed cooperatively by

[88] For this statement of the phases of the land planning process, the writer is indebted to his association with Messrs. Earl S. Draper and Tracy B. Augur in the Division of Land Planning and Housing of the Tennessee Valley Authority.

geographers in the last decade, furnish the primary materials.[89] When once these materials are in hand classification of the associated elements or of any individual elements becomes possible.

Detailed site analysis has the disadvantage of being too slow and costly for many types of land planning. In attempting to solve this problem, experiments have been tried with the sampling method, the traverse method, and the unit-area classification. In the sampling method, sample surveys are made at either planned or random intervals. In the traverse method, the surveys follow lines or strips across the area under examination. Both of these methods involve perplexing statistical questions. The unit-area type of work contains an element of classification as well as analysis. For the writer, the idea of unit-area classification carries back to a field conference in 1925. At that time I became hopeful that we might be able to perfect a technique by which one could recognize the entity of any point or area and then map that entity as far as it extended. The idea was tried out in rapid traverse work over long distances with some success and was reported at a meeting of the Illinois Academy of Science in 1933. In the past year further experiments with the method were set up but the results were unsatisfactory until the problem was allocated to the geography section of the Tennessee Valley Authority. After some experimentation, the men in this section learned how to combine the idea with the aerial mosaic-site analysis technique. The site was widened to an appropriate area, classification was added to the analysis and the unit area type of land classification became a reality.[90]

The second phase of land planning calls for an appraisal of the occupance pattern in order to discover its points of strength and its points of weakness. This involves a study of the spacing of individual elements in the pattern and the relation of each individual pattern to the composite pattern. It also demands that proposals for changes in any individual pattern be weighed as to the probable effect on other individual patterns and on the composite pattern. The ramifications of this type of work are many. It leads to investigations of the assets and liabilities of any area for particular uses. It asks if particular sites are deteriorating under use, and if so how rapidly. It implies analyses of slope and soils of a new degree of intensity. It calls for much greater knowledge of climates of slopes and thermal belts than we have at present. In this connection practical experience is placing in action some of the investigations advocated by the Mis-

[89] See Finch, Vernor C. and Platt, Robert S., "Geographic Surveys," *The Geographic Society of Chicago, Bull. No. 9*, Chicago, 1933.

[90] *Editors note.*—A paper by G. Donald Hudson dealing with the unit area method of land classification will appear in a forthcoming issue of these *Annals*.

sissippi Valley Committee, or by the Land Use Committee of the Science Advisory Board. This phase of land planning also studies the adjustment of cultural features to natural features, seeking areas or points of satisfactory or of unsatisfactory adjustment. Finally, land planning raises the all-important question as to whether or not the occupance pattern in its present status serves and promotes the physical and social welfare of society. Many of these questions call for painstaking research on the part of geographers or other scientists. Some call for evaluation by men of long experience in business. Land planning does not care who does the work, but it does care greatly for the results.

The third phase of the planning process is that of design or active planning for the attainment of stated objectives. In land planning this means the formulation of a design for the development of a progressively better occupance pattern. Design begins with a preliminary intellectual conception of something to be done or produced. It implies a penetrating knowledge of the existing occupance pattern and a full understanding of the objectives to be attained. In the acquisition of this knowledge, geography, as we have seen, plays a highly important part. It may be assumed, and we have some evidence to support the assumption, that the momentum of understanding gained by geographers during the survey, classification, and appraisal phases will enable them to make valuable contributions in the formulation of the design. Purposive planning, after all, may be thought of as the formulation and prediction stage of a sequence of scientific exploration. In land planning the sequence includes observation, analysis, classification, appraisal, formulation and prediction. Geography, with its contributions to the early stages of the process, may be expected to contribute significantly in the later stages.

Land planning by its very nature may be expected to introduce a rational element into social planning. Land planning, like geography, insists on the areal concept. It demands that the social structure be held in its physical setting. It strikes at reality and tends to hold reasoning within a rational frame of reference. It is the intelligent application of the principles of geographical science and other sciences to the problems and interests of society.

In the final phase of the planning process, that of effectuation, geographical science has, as far as I can see, little or nothing to offer. The question of putting plans into effect is a matter of administration and rests on the interest and desire of the general public. The men who administer planning programs need not be scientists; in fact, it is better if they are not interested in promoting a particular science. They do need to be, how-

ever, administrative artists in applying the findings of science to the solution of problems of public welfare.

PREDICTION

The past record of geographic thought in America offers abundant evidence of the exercise of the intellectual qualities demanded by science. Analysis, synthesis, classification, discovery, and formulation are essential mental steps in dealing with areal composites, the central phenomena of geographical science. These steps also are essential in the reasoning by which geographical science makes its contribution in the solution of problems inherent in the wise use of land, water, and other Earth resources. In one respect, however—namely, prediction—geography has done relatively little. Geography for the most part has been content with the present and the past, and has not concerned itself greatly with the future. In view of the admitted immaturity of our technique and methods, and in view also of the complexity associated with reasoning in terms of the composite, it probably is fortunate that we have not encouraged prediction.

One difficulty in geographic prediction grows out of lack of balance in our study of regions. We have, for example, gone much further with the study of physical features and the physical pattern than we have with the study of cultural features and the cultural pattern. We have examined more closely the relation of the cultural pattern to the natural pattern than we have the interrelation of areal composites. We have been much more concerned with certain components of the areal complex—as land forms, for example—than with other components, such as soils. We have been more interested in the study of rural districts than in urban areas. Fortunately, interest in urban areas is on the upward trend, and fortunately, also, it is taking the form of monographic investigation, thus preparing the way for subsequent comparisons and generalizations.

A second difficulty in geographic prediction is our relative unfamiliarity with the forces at work in the areas with which we are concerned. The occupance pattern is dynamic, ever-changing, ever-developing. What occasions the changes? In an urban area, for example, there are forces at work which have a profound bearing on the wise development of the functional pattern.[91] We know relatively little of these forces and of their expression in the urban area. We also know very little about the interlocking of urban and rural areas, and scarcely anything of the relation of one urban area to other urban areas. In my opinion, much must be learned about cities before we can treat regions to our satisfaction.

[91] Colby, Chas. C., "Centrifugal and Centripetal Forces in Urban Geography," these *Annals*, Vol. XXIII, 1933, pp. 1–20.

In connection with the dynamic qualities of areal composites, we need to examine both the variables which occasion change and the constants which make change possible. It is evident that variation could not occur unless there exist constants from which to vary. These constants, such as space, position, gravity, and sun behavior, introduce the essential stability into the areal equation, and have been called the factors of stability.[92] In their areal association, these factors are like the rules of order under which a legislative body operates. A knowledge of these rules, no matter how complete, does not enable one to predict the outcome of legislative deliberation. The rules of order are constant, but the actions of the legislative body are not. There is, moreover, a sequential relation of one factor of stability to another. Thus daylight comes with sunrise and water runs downhill under the force of gravity. Such balance of antecedents and consequences has been designated the principle of stability.[93]

In opposition to the factors of stability are variables which have been called the factors of change.[94] They tend to modify and develop the areal complex or some one of its elements. The factors of change cause divergences from the norm and lead to progress or retrogression, as the case may be. They are present in nature, degrading and aggrading river valleys, leaching and eroding soils, and in many other ways modifying natural conditions. They also are present in culture, as for example, when the construction of modern highways in the Kentucky Plateau profoundly affected the occupance and use of that area. In biology the factors of change are essential to the evolution of species. In human affairs they upset the equilibrium of economic and social forces and, perhaps, progressively change the standards and habits of a social group. Some social change—as, for example, the adoption of a far-reaching political policy—may lead to progressive modification of the occupance pattern of an area. In like manner, the construction of a long, deep, wide reservoir may bisect a political unit or sever a trade area from a trade center. Demand for copper may devastate a countryside, whereas a demand for recreation may lead to the rejuvenation of a blighted terrain. The certainty of variation under which such changes are possible has been thought of as the principle of change. Be that as it may, the possibility of change makes it logical to plan for wiser and better living in an area, and makes it necessary to measure and evaluate the effect of proposed changes before the intellectual process of prediction can be brought safely into action.

[92] Lillie, Ralph S., "The Living and the Non-Living," *The American Naturalist*, Vol. LXVIII, No. 714, Jan.–Feb., 1934, pp. 304–332.

[93] Noyes, W. A., "The Way Forward in Chemistry," *Science*, Vol. 82, Oct. 18, 1935, pp. 357–361.

[94] Lillie, *op. cit.*

In conclusion, geographic thought in the coming decades, I predict, will call for much greater accuracy and much deeper penetration than has been true in the past. The application of statistical methods, I believe, will introduce new types of measurement, will clarify present methods of analysis, and will give us results which are quantitatively exact as well as qualitatively true. Here we are on the frontier of geographical thought, for we have come to realize our insufficient preparation for this type of work. Fortunately, some of the younger men are cultivating this type of exploration and we await with high expectation the statistical wonders which we are hopeful they will perform.

The present interest in classification should bring many aspects of our work into sharper focus. Our new field methods, I am convinced, mark the dawn of a new era of geographical exploration. It is to be hoped, moreover, that there will appear a sufficient number of studies under each of the well defined philosophies of geography to enable us to evaluate their respective merits. Perhaps then a new definition and delimitation of our science will lead us on to firmer ground than we now occupy. Most important of all, it is hoped and expected that geographic thought will be directed in increasing amount and intensity into the scientific aspects of the field. Scientific inquiry is our rich heritage, and scientific inquiry, I repeat, is the outstanding responsibility and the outstanding opportunity of the present and the coming generations of geographers. May we prove faithful to the trust and equal to the task.

Titles and Abstracts of Papers
St. Louis, 1935

CHARLES C. COLBY.

Changing Currents of Geographic Thought in America.
(Presidential Address. Published in full in this issue.)

ESTHER S. ANDERSON. (Introduced by Nels A. Bengtson.)

An Annual Variability Series of Crop and Livestock Maps of Nebraska.

The annual variability crop and livestock maps of Nebraska described in this paper form the beginning of a new series which show production by the median and percentile deviations from the median for as long a period as data are available instead of the mean or average conditions which are usually used.

In making this series of crop and livestock maps, the use of productions calculated from the median for a given period of time was considered more desirable than corresponding percentiles calculated from means and standard deviations. Medians and percentile deviations calculated therefrom represent exactly what the data show, whereas percentile deviations calculated from means and standard deviations, while they represent a symmetrical picture, do not picture the data as accurately. Example, the median production of corn in Boone County for 23 years was 30 bushels per acre. This signifies that the yield was less than 30 bushels 11 times and more than 30 bushels 11 times of the 23 years. The average or mean production was 25.7 bushels per acre, 4.3 bushels below the median. The data also show that 14 times of the 23 the yield was higher than the mean and 9 times it was lower. In Nebraska, the mean or average of corn was below the median in 63 counties, above the median in 27 counties and the same in 3. In the case of wheat, the mean was below the median in 55 counties, above in 33 counties and the same in 5 counties.

Maps based on 20%, 40%, 50%, 60% and 80% productions were made for corn, wheat, cattle and swine. One who studies a 50% corn production map which shows a 30 bushel isorithm passing through Lancaster County, knows that the yield was 30 or more bushels per acre 50% of the time and that it was 30 or less bushels 50% of the period. Similar interpretations are given for the other percentile maps.

This series of maps presents a summary of conditions that have pre-

vailed. Used as a criterion in making forecasts, these maps may determine to some extent what may be expected in the future. Assuming that geographic conditions in any area are relatively constant, a farmer or investor, by scanning these maps, can make an intelligent estimate as to what he may expect different percentages of the time with respect to the yield of corn or wheat per acre. This does not hold true in cattle and swine distribution because there are many economic factors that affect their production, but from the maps may be determined which regions are likely to be best adapted to animal production.

Additional uses of these maps include studies to show the relation of the yield of a crop to soil regions; studies to show effects of climate and weather condition upon yields; studies to show the distribution of livestock in relation to grain, pasturage and hay crops; and possibly studies to show changes which occur in density of production of livestock with respect to economic conditions.

Limitations in studies of this kind include the short period of time that records have been kept; errors in obtaining accurate data; and in some cases estimation of yields.

WILLIAM APPLEBAUM. (Introduced by Richard Hartshorne.)

A Technique for Constructing a Population and Urban Land Use Map.

The construction of a map to show urban population distribution requires both detailed population and land-use data. Population data can be secured by enumeration districts; urban land-use data are generally available for every city, compiled in a Sanborn Atlas, and City Planning Offices as well frequently have such information plotted on large scale maps. Where the Sanborn Atlas does not cover the entire urban area, a small amount of supplementary field work is necessary.

With an adequate base map, city directory, census and land-use data, the construction of a map showing the distribution of population and urban land use is simple. First, the boundaries of all enumeration districts are laid off on the base map; then non-residential land uses are transferred from a Sanborn Atlas or other available sources of information to the base map, using different conventions to designate the various types of non-residential use. Family dwelling units in each city block are counted in the Sanborn Atlas and the number recorded inside the respective blocks on the base map. A city directory is consulted in the case of multiple family buildings. The number of family dwelling units is then computed for each enumeration district and divided into the number of non-institutional population within the districts; the quotient obtained represents the population index per family dwelling unit for the district. Population for each block

is computed by multiplying the number of family dwelling units in the block by the population index per family dwelling unit. The distribution of population is shown on the map by dots—10, 20 or more persons per dot. The dots designate residential land use and at the same time present a graphic as well as a quantitative measure of the distribution of the urban population. The slight inaccuracies resulting from this method of procedure are of no practical significance, well within the tolerable error.

This technique, probably the best developed to date, has been employed successfully in the study of many urban areas.

WALLACE W. ATWOOD, JR., AND EUGENE KINGMAN. (Introduced by Wallace W. Atwood.)

A New Method in Physiographic Presentation.

The unique story of earth history recorded in the alternating layers of lava and glacial material in the rim surrounding Crater Lake is reproduced by the authors in a series of five oil paintings. Each canvas represents a stage in the evolution of the glacio-volcanic landscape as interpreted by the geomorphologist. The scientific basis for each view presented.

In a similar manner the authors have reproduced the various stages in the evolution of Yosemite Valley. This series of five paintings has been prepared in collaboration with François Matthes and illustrates the various glacial and pre-glacial landscapes recognized by him.

The purpose of these two series of paintings is to combine the scientific with the artistic, thereby illustrating clearly and effectively the results of field investigations. It is believed that this method of presentation will prove valuable in preparation of scientific reports and in museum and National Park exhibits where physiographic material is presented to the public. The paintings were prepared by Eugene Kingman, who spent much of the past season in the areas represented.

W. O. BLANCHARD.

Two Decades of the Panama Canal.

Traffic Trends.—The trend in traffic through the Canal for the 20 years shows three periods.

(1) The initial 15 years of continuous growth, the first 8 showing a slow increase; the next 7, a rapid rise due to the California oil boom and improvement in world shipping.

(2) From the peak of 1929 precipitous decline to 1932, reflecting the economic depression.

(3) A partial recovery from 1932–1934, corresponding with improvement in world shipping.

Regions Influenced.—The waterway is of negligible importance for the Atlantic margins of South America and Africa and for the Far East and Australasia. The United States is dominant. American *domestic* commerce accounts for over 1/2 of the total; American *foreign* commerce accounts for another 2/5. This leaves only 1/4 of all the Panama traffic between countries other than the United States.

Routes Affected.—The United States intercoastal with 33.5% and the United States to the Far East with 21.3% together account for over 1/2 of the total. In the opposite direction, the United States intercoastal with 35.6%; the United States to Europe with 15%; and South America to Europe with 13.6% play the chief rôle, accounting together for about 2/3 of the total.

Influence on United States Railways.—In 1911 American transcontinental traffic was estimated at between 5 and 6 million tons. In 1929 the intercoastal movement via Panama was double that. Considerable rail freight was diverted to the new water route, but much was new business. The Canal is estimated to save about $10.00 per ton over the railway rates and in addition it keeps the rail rates down. It seems probable that the savings to shippers on United States intercoastal traffic alone would justify the expense of the Canal.

Commodities Moved.—There has been a marked difference in the tonnage moving through the Canal in opposite directions. The Pacific countries contribute bulky products—lumber, wheat, petroleum and preserved fruits and fish from North America; nitrates and iron ore from South America. The chief exception is the Far East whose exports are more compact and valuable, e.g., raw silk and tea. Atlantic commodities are manufactures of small bulk and high value, iron and steel goods being the leading items. A lack of balance in cargo movement has resulted. For the whole period the ratio of tonnage from the Pacific to that from the Atlantic has been about 2:1. In 1934 it was 3:1 and for certain individual routes the difference is still greater.

The Future.—As to the ability of the Canal to care for future traffic there seems little reason for worry. The Canal could have passed three times the number of vessels in 1934. With a third flight of locks the capacity would be increased to five times the present volume of traffic.

CLYDE J. BOLLINGER. (American Meteorological Society.)

Influence of Sea Temperature Anomalies on Seasonal Temperature and Rainfall Departures in the Southwest.

Statistical correlations between monthly rainfall departures in Oklahoma during the period 1920–1930 and surface-water temperatures of antecedent

months in Central American seas provide evidence of strong marine influence on the climate of the Southwest, especially during July and August when the monsoonal indraft of tropical gulf air masses is strong. The correlation charts reveal that abnormally warm seas tend to produce rainy cool weather in summer and dry frosty weather in autumn. The locus of maximum marine influence on March and April weather is in the Western Gulf of Mexico but appears to shift to the Eastern Gulf in May, and back to the Western Gulf and Caribbean Sea in July and August. Although the period of observation, only ten years, is too short for safe generalization, the following coefficients appear significant: April rainfall and Western Gulf temperatures of February positive .60; May rainfall and Eastern Gulf temperature of May .57; July rainfall had a .52 correlation with Western Gulf temperatures of June and the surprisingly high correlation of .74 with Caribbean temperatures of February, five months earlier. October rainfall had a negative .56 correlation with August temperatures in the Western Gulf.

The negative relations of autumn appear to arise from a tendency for abnormally warm seas to reduce atmospheric pressure in the Gulf area thus creating a pressure gradient favorable for early southward movement of polar continental air masses at that season. In spring and summer the effect of sea temperatures upon evaporation and thus upon the vapor content of the southerly winds appears to be the most important controlling factor. August departures in the depression of the dew-point at Oklahoma City, which may be considered an indicator of atmospheric humidity, had a significant correlation with August rainfall departures at that station for the period 1891–1930 and with gulf temperatures of antecedent months during the period 1920–1930.

Since evidence of an influence, at least during the period 1920–1930, of solar constant departures on the temperature of the Caribbean Sea and Gulf of Mexico has been found,[1] evidence here presented of an influence of sea temperature anomalies on weather appears to complete an unbroken chain of causation connecting solar radiation and climate in the Southwest, thus providing confirmation, at least for one decade, of the writer's solar-marine hypothesis of cyclic climatic and crop yield fluctuations in the Southwest.[2]

[1] Bollinger, Clyde J. The Rôle of Caribbean and Gulf Temperatures in Solar Control of Climate and Crop Yield in the Southwest, *Bulletin of the American Meteorological Society*, 16 (May, 1935), pp. 140–142.

[2] Bollinger, Clyde J. The Relation of Oklahoma Weather and Crop Yield to the Eleven-year, Sunspot Cycle. *Ibid.*, 15 (Jan., 1934), pp. 28–29.

ALFRED W. BOOTH. (Introduced by Glenn T. Trewartha.)

A Population Study of the Southeastern Dairy Region of Wisconsin.

In its population trends and its population density, distribution, and arrangement the Southeastern Dairy Region of Wisconsin conforms closely to the average for agricultural regions of the drift plains of mid-western United States. Within it the population may be divided into four groups: (1) rural; (2) in hamlets (25–200 population); (3) in villages 201–1000 population; and (4) in towns or small cities (1001–5000 population).

SAMUEL T. BRATTON. (Introduced by Lewis F. Thomas.)

Quantitative Geographic Relationships.

This study is an attempt to determine, in a small area, those features of the cultural landscape due unmistakably to natural environment, and to evaluate quantitatively the relative importance of the natural conditions involved.

The agricultural area used is located in central Missouri, Boone County, and contains about equal amounts of flattish and rolling land. Data were obtained from field study, soil analyses, and from occupants. On a map of the area the cultural features found to be due to natural conditions are shown by stippling, and are numbered. Cultural features found not explainable in terms of specific natural conditions are unstippled.

Computations involving the stippled and unstippled areas show that approximately 41% of the cultural landscape is explainable in terms of natural environment. For the remaining 59% the field study failed to find specific cultural-natural relationships.

Computations involving the stippled areas show that slope ranks first as a known environmental factor and accounts for the particular uses of about 57.3% of such areas. Soil conditions rank second and account for about 35%. Adjustments to streams and gullies require about 5.7%, drainage 1.3%, and wet land less than 1%.

The primary value of this study is limited to the particular area involved, but the findings suggest that the interpretation of a cultural landscape involves conditions other than natural environment; also, that the influences of natural conditions in relation to cultural features are capable of quantitative measurement.

RALPH H. BROWN.

The Roswell Region, New Mexico.

Westward of the Pecos River and roughly paralleling it for sixty miles in south-eastern New Mexico is a narrow, discontinuous belt of artesian wells penetrating the cavernous Picacho limestone marking the nether

slopes of the so-called Roswell Artesian Basin. The most significant and representative portion of this basin is the northern segment, of which the city of Roswell, third in size among New Mexican cities, is the economic and social capital. The region includes some hundred square miles of productive land irrigated chiefly from flowing and pumped artesian wells and is distinguished by compactness of settlement by varied racial stocks and by general maturity of cultural development.

A generalized view of the region in its natural setting, framed to the westward by two members of the trans-Pecos highlands—Sierra Blanca and the Capitans—is provided by a three-dimensional regional diagram drawn in two-point perspective. The fore part of this diagram represents the occupied area as if seen obliquely from aloft at a considerable elevation. The occupied area, which includes all the irrigated land in the Roswell region, was accurately mapped in the summer of 1935 but the resulting map is apparently in such detail as to render it unsuitable for brief presentation to a listening group. Consequently this map has been transposed into a large-scale perspective drawing which permits a portrayal and analysis of the pattern with a greater facility than could be expected from the original map. Arrows pointing vertically from aloft into the oblique drawing further aid in the ready identification of the more significant details which in their various associations comprise the entire scene.

The pattern is found to include some relict forms: abandoned irrigation ditches used in the pre-artesian well period (before 1890), occasional large land holdings traditional in the antecedent period of far-flung cattle ranches in the 1860's, and clusters of orchards which are essentially the present-day remnants of vaster orchards set out in the period of vigorous settlement from 1900 to 1910. Contrasts in patterns are also shown; especially the contrast provided by the rectangular lines of the strictly artesian area and the varied outlines of the lands watered directly from Rio Berrendo. Included also in the pattern are regions of decadence due either to declining well pressures or increasing salinity. The interstices of the pattern are principally occupied by fields of cotton, alfalfa, corn and cane, with smaller areas of orchard and garden truck. Despite the recessional features referred to the pattern is believed to be one of reasonable stability.

WILLIAM S. COOPER.

Color Movies from the Fiords of Southern Alaska.

A pictorial presentation.

WILLIAM S. COOPER AND W. O. FIELD, JR. (Introduced by William S. Cooper.)

Glacial Studies in Southern Alaska, 1935.

During the summer of 1935, three weeks were spent in Glacier Bay and four in Prince William Sound and its vicinity. Detailed surveys were made of the positions of the principal glacier fronts by transit and camera. In Glacier Bay, the ice cliff of the Muir Glacier has continued its recession; it is now about half a mile farther back than in 1929. Among the other glacier fronts, some show slight retreat since 1929, some slight advance, while others have remained practically stationary. On the whole, it is evident that, except for the Muir, the period of abnormally rapid retreat, dating back a century or more, has come to an end. In front of the Hugh Miller Glacier, opportunity was afforded to observe an extensive pitted outwash plain in process of formation.

The glaciers of Prince William Sound show no evidence of rapid retreat during the last century comparable with what has happened in Glacier Bay. In most cases, the ice fronts are practically in contact with mature forest, thicket or alpine mat, that has required several centuries for its development. A spruce close to the front of the Harvard Glacier proved to be 250 years old; another near the Blackstone Glacier was 450 years old. A hemlock six feet tall and five inches in diameter, a few hundred feet from the front of the Columbia Glacier, was 400 years old. Mere absence of forest, on the other hand, is no certain criterion of recent ice recession. Willow-alder thicket, and even alpine turf-mat, may be as old as a forest of huge trees. Expert interpretation of the vegetational evidence is as necessary as knowledge of the physiographic phases. As a group, the glaciers of Prince William Sound are at the present time as far advanced as they have been during the last half-thousand years at least.

The striking difference in recent glacial history between Glacier Bay and Prince William Sound presents a difficult problem with possible far-reaching implications. For its solution, a comprehensive survey of present conditions at all the major ice fronts from the Stikine River to the Kenai Peninsula is necessary, in which vegetational evidence will play an important part. Equally necessary is the continuation of periodic surveys of the ice fronts, and extension of the work to the whole length of coast where glaciers end in convenient proximity to the sea. Glaciers ending on land should be given particular attention, since they are more accurate indicators of climatic change than those bathed by the tides.

CHARLES M. DAVIS. (Introduced by K. C. McMurry.)

The Use of Geographic Material in Political Readjustment.

The present system of political divisions in the northern part of southern Michigan was instituted long before the quality of the land was deter-

mined. Although divided into counties and townships a large amount of this area did not progress into agricultural use after the removal of the forests by lumbering operations. Recent investigation into the cost of these many small political units by the Michigan Commission of Inquiry into County, Township and School District Government, has shown beyond doubt that the present setup is not efficiently serving the needs of the area. It is expected that some readjustment of the political units will be undertaken in the near future.

In order that the new system may be functional it is advisable that this be drawn more or less upon the same criteria by which geographers recognize their "regions." The materials collected for regional inventory may well be used as a basis for departure. This presentation is a suggestion for the redistribution of the political units in a section of the Michigan cut-over lands called the "High Plains." The regional inventory in this area was done for the purpose of investigating the regional design but the materials thus derived are those essential to the setting up of functional political units.

Political readjustment in the High Plains must take into account four classes of land:

1. A large area of partly-wooded "wild" land, both privately and publicly owned.
2. A concentrated recreational area with large investments in facilities and individual problems of government.
3. A struggling, second-class agricultural district.
4. Several towns or large villages and two small cities.

The presentation suggests drawing new boundaries on the basis of the following criteria:

1. The inclusion of the state-owned wild land and privately owned land of similar quality lying between the state units into a few large units to be administered by the state on a "territorial" basis.
2. The creation of a separate district for the recreational area and its agricultural umland. This would include three of the most important towns.
3. Making no changes in the setup of the present agricultural district beyond the paring off of wild land under the present county jurisdiction.

The step by step delineation of the stages of this political readjustment will be presented by maps to indicate the manner of justification of the units thus set up.

DARRELL HAUG DAVIS.

Amana: A Study of Occupance.

Amana was and still is primarily the outgrowth of a religious belief, with communism incidental and its success possible only with isolation. As

outside influences penetrated, internal dissatisfaction and malingering increased until impending bankruptcy forced reorganization in 1932. The evolution of the insolvent communistic Amana villages into a successful stock company not only supplies an example of the failure of communism but furnishes as well information as to the effect of a unique type of occupance under a conventional economic system.

The several villages comprising Amana, and around which agriculture and industry are organized, are located either on terraces or the lower slopes of the valley sides of the Iowa River about twenty miles to the west of Iowa City in one of the good agricultural areas of diversified resources of Iowa, well served by rail and road.

The villages lack distinct business sections, but there is a grouping of community barns and industries. Houses are substantial, often large but never pretentious structures of unpainted wood, brick or stone. They are commonly covered with grape vines, set in gardens of old-fashioned flowers and surrounded by fruit trees. With their accompanying sheds, they often cover a surprisingly large fraction of the building site. Each village has its own meeting house, school, and numerous service enterprises. The villages constitute a sort of Federation; the Community as a whole is to a great degree self-sufficient.

The total population of the Community, including 135 non-members of the Society, is 1461 persons. Females outnumber males in the ratio of 115:100; adults outnumber minors in the ratio of 214:100. Of the 612 members of the Society gainfully employed, 301 work on the farms; 144 in manufacturing plants as woolen mills, woodworking plants, flour and grist mills, etc.; the balance in service enterprises. Agriculture is the basic industry.

This experiment in co-operative corporate economic activity is favored by inherited occupance pattern. The unit of land, 26,000 acres, is large but not too large and the organization of agriculture around the villages results in economy of land and building use together with a centralized labor and equipment supply without undue isolation from the fields. The integration of all economic activities in the Corporation, with the inherited system of factories, makes possible partial elimination of slack seasons of employment and affords controlled markets for local production. This experiment should supply data of interest and value.

SAMUEL N. DICKEN. (Introduced by D. H. Davis.)

Ground Water and Settlement in the Middle Sierra Madre Oriental, Mexico.

The middle Sierra Madre Oriental in southern Nuevo Leon consists of high ridges and basins, developed on folded and faulted limestones. The

region receives a moderate amount of rainfall, 15 to 30 inches (probably), the greatest amount falling on the east slope of the ranges. But due to the soluble nature of the underlying limestones surface water is scarce and most of the settlements depend on ground water for irrigation and household uses. As a result of the overturned, almost isoclinal folds, many of the ridges are in the form of hogbacks, with the dip slopes to the west and the escarpment to the east. Since the bedrock contains many relatively impermeable beds, there is a strong tendency for the ground water to move down dip and appear in springs at the foot of the dry, leeward slope. Most of the settlements which depend on ground water are located near the foot of the leeward slopes where there is enough basin land for cultivation. Exceptions to this condition are found in the northern part of the region where the ridges and valleys are oriented east-west and are therefore exposed to the rain bearing winds; some settlements are primarily concerned with dry farming or the gathering of native plant fibers; others obtain water for irrigation from the alluvium of the basins. Most of the large settlements, however, depend on ground water for the irrigation of corn, even though their most important product may not be directly related to ground water.

STANLEY D. DODGE.

Population Changes Along the Coast of Maine.

The population of Coastal Maine, centered originally at many points, has shifted with alterations in the fortunes of coastwise and foreign shipping, the lumber trade, and the railroads. The development of the present pattern of population is traced out, for the coastal counties of the state, in terms of these economic changes and the associated alterations in the conditions of the landscape.

LOYAL DURAND, JR.

Geography in its Relation to State Planning in Wisconsin. (Invited Paper.)

Geography has contributed much to the field of state planning in the United States. By adherence to a regional point of view the geographer has helped orient planner and administrator alike, and has aided in indicating that many of our state problems are regionally distributed within the state boundaries or that regions of similar problems are shared alike by neighboring states.

Wisconsin is a state possessing strong regional contrasts, and having distinct regional problems within its borders. The Central Sand Plain of Wisconsin is a marked geographic region that is a "problem" area localized

within the state. The state, however, also contains portions of broad regions that are interstate in character, such as the share of the Great Lakes Cut-Over Region that is located within Northern Wisconsin, or the Hill and Valley Erosion Region of the Driftless Area of southwestern Wisconsin.

The geographic contribution to the regional problem of Wisconsin has been the determination of associations characterizing and giving identity to each region, the providing of a regional point-of-view, the integration of the problems of area with the natural equipment of area, and the compilation of map and statistical bases for study of areal complexes and for delimitation of regional boundaries.

The maps of Wisconsin, basic to the general problem region map of the state, were all constructed on a township basis. These range from maps showing a single feature, such as the acres of harvested crops per farm, to maps showing combinations of associations, as for example the acres of harvested crops per rural farm person. Additional maps constructed for supplementary data for regional interpretation are maps showing necessary state aids, as the school aids by townships, and maps indicating tax delinquency and similar economic conditions as exemplified within area. Some thirty such maps were constructed.

A preliminary step in the state planning work was in delimitation of the Problem Region Map of Wisconsin, a map to which geography and the regional concept was fundamental. The long time program of state planning calls for continued regional study within Wisconsin, a theme which has geography as a basic and necessary foundation.

FRANCES M. EARLE. (Introduced by Frank E. Williams.)

Agricultural Trends in Hokkaido.

The island of Hokkaido is in process of developing a distinctive agricultural economy based upon diversified agriculture of the northern type, including expansion of the animal industries.

Rice, the traditional food crop of the southern islands, was pushed northward into the Ishikari Basin by the development of hardy, quick-maturing varieties. Because of the uncertainties of weather during the summer season government authorities are now discouraging the further expansion of rice lands. On the other hand, approval is given to diversified cool-climate crops including the white potato, wheat, sugar beets, beans, and flax.

Increasing emphasis is being put upon the animal industries, including the raising of corn for silage. Farmers are encouraged to keep a few sheep and use the wool for making homespuns. Climatic conditions favor dairy-

ing and through cooperative societies of the Danish type rapid progress has been made in increasing the number of cattle, improving breeds, and in standardizing and marketing dairy products. The canning of milk, the canning and preserving of fruits and vegetables, and the manufacture of milk chocolate are increasing in importance.

The colonization program which is now receiving more attention than in the past is chiefly concerned with the clearing and settlement of the eastern half of the island. Colonists are now selected more carefully, to avoid those unsuited to northern pioneering. Developmental plans for Hokkaido emphasize the desirability of industrialization which, if effected, will increase the use of agricultural raw materials. The Hokkaido government hopes to make the north island an exporter of food stuffs to the South.

ALICE FOSTER. (Introduced by Wellington D. Jones.)

Major Geoponic Types of the Vega de Valencia.

In the Vega de Valencia, areal differentiation appears as a landscape feature characteristic of geographic maturity. The geoponic pattern is formed by a series of areal units, each representing the extent of a particular geographic complex. While variety in detail is manifold, the geoponic units fall into four groups or types which differ in crop combinations and in characteristics of terrain. These four types, each named for a locality where the type is well developed, are the *Alboraya Type,* the *Liria Type,* the *Sueca Type,* and the *Alcira Type.* The agriculture of the Alboraya Type probably is the climax for the Vega. The fields, which occupy low-lying but well-drained alluvial tracts with clay soil, bear a sequence of short-season crops, including cereals, legumes, and truck crops, watered from streams by means of long-established canal systems. Fruit trees border the canals and cluster about the residences, which typically are concentrated in villages. The type area is the famous *huerta* of the Turia delta, within which the city of Valencia has a central location. The onion is the principal export commodity, and oranges are of minor importance. The Liria Type is restricted to the less favored portions of the Vega, claiming the hilly belt between the irrigated areas and the untilled mountain tracts. Scanty water resources and dry-farming practices are characteristic, and the population is concentrated at points where springs or streams furnish water for domestic purposes and for irrigating small tracts of *huerta* land. The principal commercial crops are the vine, the olive, and the algarrobo, grown under dry-farming methods. The soil in most areas of the Liria Type is exceedingly congenial to these crops because of its high lime content, but dependence upon an erratic rainfall makes the yield very

irregular. The Sueca Type is characterized by the utilization of terrain in transition from submergence to adequate drainage. The principal areal unit is the Ribera del Júcar, a former arm of the Mediterranean still not completely filled. The distinctive commercial crop is rice, which serves as an instrument in the long-term reclamation of emerging terrain. According to the stage of reclamation, rice is grown under a monocultural plan, alternates with a winter legume crop, or forms one member of a diversified crop combination. The Alcira Type consists of orange-growing piedmont plains irrigated from wells. It is the youngest of the geoponic types and represents geographic rejuvenation of areas with soil of low water-holding capacity which lie above the level of the long-established canal systems. These areas were of low utility so long as their ground-water resources remained inaccessible. Being absent from the area adjacent to the city of Valencia, the Alcira Type breaks into a northern and a southern unit, with commercially important contrasts in crop season and crop qualities.

Otis W. Freeman.

Columbia River Development: Wisdom or Folly?

The Columbia River drains 259,000 square miles. From the Canadian Boundary to Bonneville the river drops 1300 feet. The average total flow of the Columbia equals 146,000 acre feet. The flow of the Columbia at the Grand Coulee dam site is five times that of the Colorado River at Boulder Dam. The Columbia is the greatest power stream in North America, 8,000,000 kilowatts can be developed at ten major power sites from Bonneville to Grand Coulee. One power site, at Rock Island near Wenatchee has been developed by private capital. Two sites, Bonneville and Grand Coulee, selected as Public Works Projects by the Federal Government are under construction by private contractors. Bonneville, 40 miles east of Portland in the Columbia River gorge, is under supervision of U. S. Army engineers. This dam will generate 150,000 H. P. and a lock 65 feet high will allow ocean boats to load cargoes at The Dalles.

The Grand Coulee dam in north central Washington is being built across the Columbia River under supervision of the U. S. Bureau of Reclamation. The dam site in a granite gorge will contain a dam 500 feet above bed rock, 450 feet thick at the base and 4100 feet long, containing 9,600,000 cubic yards of concrete. Installed capacity at the start will total over 600,000 H. P. Part of this power will pump water from the lake to a storage reservoir on the floor of Grand Coulee, 600 feet above the Columbia. From here canals can irrigate one million acres of fertile desert land.

Opponents of dam construction on the Columbia River argue that (1) no adequate market for power exists, (2) there should be no more reclama-

tion of arid lands because of present over production of crops and (3) the salmon industry would be injured.

Proponents for development believe that new industries like aluminum, nitrates, electro-metallurgy, etc., along with use for irrigation pumping and increased domestic consumption will soon use all the installed power capacity. Irrigation development will be slow, about 20,000 acres per year, and fifty years may elapse before all the million acres in the Columbia Basin are irrigated. Most of the crops will be sold locally in new industrial towns resulting from cheap power. 250,000 people will ultimately live on Columbia Basin irrigated lands and as many more in nearby industrial cities. This population will form a new market for goods and will import over 200,000 car loads of goods annually from all parts of the United States.

Fish ladders, fish elevators and salmon hatcheries should save the salmon industry from destruction.

Improvements to navigation on the Columbia and the Bonneville ship locks should lessen freight costs to the Interior.

Since Columbia River development for power, irrigation and navigation will cause the use of resources now unused, create markets and cities where none now exist, help the growth not only of the Northwest but of the whole country, large expenditures of money for such development are economically justified. Columbia River development is wisdom, not folly.

HERMAN R. FRIIS. (Introduced by R. H. Whitbeck.)

Sakhalin Island: A Study in Chorographic Geography.

Sakhalin Island is a long, slender, partially bifurcated land mass extending longitudinally north and south, roughly parallel to the eastern fringe of the Siberian mainland. Its northern tip lies just beyond the mouth of the Amur and its southern extremity nearly touches Hokkaido. Approximately nine-tenths of the total area of some 30,000 square miles consists of hill lands and rugged mountains; the lowlands are largely limited to a narrow littoral with several good-sized aggradational plains fronting onto the sea.

The transitional character of the island between the subarctic and north temperate regions is strikingly shown in the physical landscape, notably soils, climate, vegetation, and major landforms. The cultural landscape so recently superimposed upon this fundament reflects the transitional character of these physical elements, although with the advent of modern science in pioneer settlement the boundaries of profitable colonization are moving rapidly northward.

By reason of its land-bridge character between the Asiatic continent and insular Japan, Sakhalin Island has experienced the vicissitudes concomitant

with being on the fringe of colonial activity. The island has been a threshold over which have passed the cultures of several different peoples. Each passing has left some imprint of its presence. Four periods in the sequence of occupance may be defined: (1) The initial period during which primitive peoples were attracted to the island as a refuge from encroaching cultures and because of its wealth in fish and furs. These peoples are now making a last stand against the advancing frontier of modern civilization; (2) the early period of exploration and cursory exploitation during which the island was a condominium of Russia and Japan, (1620–1870); (3) a period of complete ownership by Russia and use of the island as a penal colony for political exiles and hardened convicts, (1870–1905); and (4) the present nearly equal division of the island between the U. S. S. R. and Japan.

The present landscape of the island affords an excellent regional study of the contrasts between the portions controlled by Japan and the U. S. S. R. Japanese Sakhalin is an area undergoing change through a thoroughly modern, planned, scientifically sponsored endeavor in colonization and exploitation; Russian Sakhalin is a static, unsystematically exploited area of sparse population.

Reuel B. Frost. (Introduced by V. C. Finch.)

Urbanization Along the Southern Shoreline of Lake Erie.

Urbanization along the Southern Shoreline of Lake Erie is best exemplified by eight commercial and industrial cities in the states of New York, Pennsylvania, and Ohio. From the eastern end of Lake Erie, westward, they are: Buffalo, N. Y., Erie, Pa., and Conneaut, Ashtabula, Cleveland, Lorain, Sandusky and Toledo, in Ohio. These cities vary in size from that of Cleveland, with more than 900,000 population, to Conneaut with slightly less than 10,000 people.

These cities have grown up in essentially the same natural environment and have many cultural characteristics in common. One of their principal functions is in the transshipment of coal to the other Great Lakes cities and of iron ore to the furnaces of "The Valley," and Pittsburgh District. But a much more important function, so far as urban growth is concerned, is in the receipt of iron ore for local consumption. Factories create opportunities for labor and in turn cause urban expansion and population growth.

Urbanization along the lakeshore has occurred during five periods distinguishable from the curves of population growth. They are, the pioneer settlement period, the canal period, the railroad period, and the period of industrialization.

The reduction of iron ore and the manufacture of steel at the point of

transshipment, together with the erection of multiplicity of factories, large and small, that are dependent upon these basic materials, have enabled the larger cities, like Cleveland, Buffalo, Toledo, Erie, and Lorain to continue to grow.

ROBT. M. GLENDINNING. (Introduced by Charles C. Colby.)

The Problem of Placing a Reservoir Severance Line.

One of the many problems arising from the creation of a reservoir is that of determining how much land should be purchased in addition to the area to be flooded. This problem becomes extremely complex when a reservoir is constructed in an area of intensive land use and dense population. The public or private agency building a reservoir should attempt to solve this problem—otherwise it ignores its obligations to persons whose economy is deranged and fails to protect its own investment. A severance line (outer edge of land purchased by the agency) should be placed so as to represent the closest possible adjustment to the physical and human factors of the area through which it passes. This involves a study of, and adjustments to, the prime factors of landforms, erosion, drainage, land holdings, rural businesses, health, destroyed or partially destroyed urban units, and costs. An ideal severance line, one which completely satisfies all of the problems growing out of the above factors, is probably impossible of attainment. Under such a condition, a severance line may have to be placed so that the vast majority of associated problems are solved, even though other problems less in numbers and significance evade solution.

CHARLES GOOZE. (Introduced by Helen M. Strong.)

Land Classification in Land Planning: A Progress Report.

From the ferment of ideas on means to effect economic adjustment, many minds have drawn off land planning concepts which emphasize the geographic approach. Synthesis has become a byword; synthesis in the sense of the process of deriving integrated entities from disparate factors. That the esoteric geographic antecedents of the principle have been obscured is perhaps to be deplored. That the principle has attained wide-spread recognition, however, is cause for national and professional gratification.

In the field of land planning, the application of the geographic technique has gained a highly pragmatic form. This is loosely termed land classification. Urgency, expediency, and bias attributable to the source of planning impulse have accounted for broad divergence in methodology. Although recent progress in many phases of land classification represents an advance of prime magnitude, gratification may well be tinged with apprehension. Booms in ideas may have results no less destructive in degree than periods

of frenzied speculation in land or securities. Whereas mere inculcation of the idea of land classification a few years ago entailed great effort, a major need of the present is the coordination of a number of planning programs embracing classification of land. In some cases, the coordinating, if fully developed, would involve actual restraint.

Some guidance is to be had in the variety of land classification activities now current. An analysis of such activities forms the substance of this survey. The discussion is confined to those projects represented by the demarcation of areas on the basis of differences in use-capabilities. Land classification as a planning tool gravitates toward such areal expression of use-capabilities. The areas marked by comparative uniformity of use-capabilities, by distinctive potential occupance patterns, have acquired the label "use-districts." At once this implies the planning and administrative ramifications of the term, for the use-district is ordinarily outlined with regard to recommended use. The paper emphasizes the nature and purpose of these districts as developed by the several land classification programs.

Otto E. Guthe. (Introduced by Chas. C. Colby.)

Community Problems Related to Reservoir Severance.

Aspects of human geography incidental to work of the Tennessee Valley Authority.

William H. Haas.

The Jíbaro, An American Citizen.

The Jíbaro is an American citizen of whom few Americans are aware and of whom not many Americans can feel very proud. He, in a measure, is to Puerto Rico what our Southern Mountaineer is to eastern Kentucky. He has become lost, both socially and economically, in the hills of Puerto Rico where history has ignored him and passed him by. American citizenship has not changed his status. His wretchedness, in the main, beggars description. It is difficult to escape the ever-present spectacle of abject poverty in going about the Island, literally "seething with misery." The American's efficiency in exploiting all the good lands for sugar is making him less needed as a peasant laborer and he is being pushed still farther inland into the already highly overpopulated hills where he exists as best he may. But the PRERA, the first outside attention he has ever received, is bringing about an awakening. The problems confronting him are overpowering.

Roland M. Harper.

Regional Contrasts in Italy, Illustrated by Statistics.

The main purpose of this study was to show how the geography of a distant country can be studied by means of census data and other current

statistics, without visiting it. Italy was selected on account of the availability of some very recent statistical yearbooks, giving a great variety of information about the country and its people. In some of the tables in these books the country is divided into four sections (northern, central, southern and insular), and sectional averages given; and many other kinds of data given for single departments can be assembled by sections, with interesting results.

The contrasts found between the two extremities of the country may be due to climate as much as anything else, though historical factors also need to be considered. But a study of finer details might bring out many correlations between geology, soil and topography on the one hand and civilization on the other, as in the United States. In the whole country 23.2% of the homes are on mountains, 42.5% on hills, and 34.2% on plains. The variations between different sections in this respect are less than one might expect. Summer temperatures are about the same in north and south, but the south of course has milder winters. Summer is the dry season, as in the Mediterranean region generally, but the northern and central portions have much more rain in June than in July.

Measurements of soldiers show the stature of men to decrease pretty regularly from north*east* to south*west*. The earliest marriages and highest birth-rate are in the south*east*, and the other extreme in the north*west*. The southeastern section has the fewest cities and the most farmers. Illiteracy increases and the consumption of tobacco decreases from north to south. The two islands (Sicily and Sardinia) are extreme in some respects and intermediate in others.

The ratio of male to female births is a little less now than it was sixty years ago, and seems generally to be lowest where the population is densest. In the general election of 1934, 99.84% of the voters favored the present administration, but what little opposition was manifested was strongest in the north and in the larger cities.

The paper was illustrated by a map, six tables and seven graphs.

RICHARD HARTSHORNE.

Suggestions on the Terminology of Political Boundaries.

In specific boundary studies one needs more precise terms than are generally available, and it is from such studies that the most useful terms have been evolved, notably by Sieger, Maull, and Sölch. In the study of Upper Silesia and subsequent discussion with Professors Whittlesey and Stephen Jones, a number of terms have been developed. An *antecedent* boundary is a political boundary that preceded the development of most of the features of the cultural landscape. A totally antecedent, or *pioneer*, boundary is

found where the line was drawn before settlement; until such settlement takes place it may be said to be in its *virginal* form. An antecedent boundary which has been abandoned for political purposes but is still evident in the cultural landscape may be called a *relict* boundary. Most European boundaries are *subsequent* and we can discern in each the degree of *conformity* with major or minor divisions of natural and cultural regions. A subsequent boundary notably lacking in conformity to a particular set of features may be said to have been *superimposed* on those features. Once accepted by the states and people on either side such a line tends, in time, to become *intrenched* in the cultural structure of the area.

Sieger, and others since, have shown the confusion engendered by the use of the term "natural boundaries," in itself a fundamentally illogical concept. We may distinguish: *naturally marked boundaries,* where some natural feature marks a line used for a boundary; *natural defense boundaries, natural barriers to trade,* and *natural communication divides,* differentiated further as to *degrees of hindrance.*

Beyond this, everyone recognizes that certain natural features provide more permanent and satisfactory political boundaries than others because population areas tend to separate along those features. Such naturally separating features have a *static* aspect, due to a zone of relatively unpopulated area between populated regions, and a *kinetic,* or hindrance, aspect that makes difficult the connections between regions on either side. Where any natural feature has in fact operated in either or both of these ways as a *natural divide,* we may say that a political boundary along it is *consequent* upon the dividing feature.

The strength of the static aspect varies with the degree of lack of population. The absolutely unpopulated water and ice areas are particularly effective because of the psychological effect of lack of community feeling. The kinetic aspect varies with the degrees of hindrance involved, from absolutely impassable ice sheets to the minor difficulties of hills and rivers. Water bodies require a special classification because while impassable for men in their ordinary occupations, they are all easily crossed by special means. In both cases the strength of the divide is further proportionate to the width of the zone involved. These three factors can be expressed in a formula, such as II B 1—II indicating an area nearly but not entirely unpopulated, B, an area difficult but not impossible to cross, and 1, of the first magnitude, *e.g.,* the Sahara. The effectiveness of such divides, however strong, is also dependent on the stage of population, technical, and political development in the bordering regions, and on their productive size in comparison with each other and with the dividing zone itself.

J. W. HOOVER.

The Navajo Land Problem.

The Navajo Indian Reservation includes an area of over 23,000 square miles, but the real Navajo country—that occupied chiefly by Navajo—comes nearer to 25,000 square miles. The Indian population of the reservation area is nearly 50,000. Though thinly spread, this population is pressing hard upon the sustenance power of the area. The Navajo tribe has increased five-fold in five decades and the rate of increase has accelerated. While the people have been increasing, their flocks have been increasing even more rapidly, and at the same time their lands have been deteriorating.

From the standpoint of land utilization the Navajo country is marginal land. When first the Navajo began to practice livestock grazing the demands upon the land were not intense and a satisfactory adjustment was worked out which met the conditions of the area. But the dynamic factor of population increase has rendered the loose organization of land use inimical to the preservation of the range.

In the deterioration of Navajo lands, erosion is the most serious factor. Less noticeable but no less insidious than the conspicuous growth of gullies, are the effects of wind erosion and the more general sheet erosion. Most students of the problem find the reasons for the accelerated erosion of recent years chiefly in the cultural conditions of the Southwest. In view of the present tendencies, it becomes a reasonable theory that areas may have been abandoned in prehistoric times when erosion made them untenable. Relatively dense populations of the past may have ushered in a series of processes akin to those of the present. In seeking a solution of the present erosion problem, the natural process of erosion and sedimentation, and also the natural balance with vegetation and animal life, should be given special study.

The Navajo Erosion Control Project is most directly and actively concerned with the Navajo land problem. The work includes the carrying out of all types of soil erosion measures. The project includes an experimental area of sixty-seven square miles and eleven demonstration areas.

The Navajo flocks are now estimated to number 1,086,000 head of sheep and goats. The government recommends a reduction of the Navajo flocks by nearly half, as necessary to preserve the herbage of the range and to protect the soil. If this is done some way must be made possible whereby he can keep his low standard of living at least at par. There is much room for improvement of the Navajo stock. The agricultural resources of the country have by no means been exhausted, and with development of the water resources of the country, the Navajo will have to become less nomadic

and more agricultural. Possibly the Navajo will need more opportunities for remunerative employment. As the man receives wages, the women cease to weave blankets. Should the government subsidized employment cease, the Navajo must needs go back to the old life deprived of luxuries for which he has cultivated a craving, to add another discontented element to our population.

G. DONALD HUDSON.

The Unit Area Method of Land Classification. (Invited Paper).

The unit area method of land classification as developed by the Land Classification Section of the Tennessee Valley Authority grew out of the scientific and practical necessity for techniques that bridge the gap between detailed field analysis and reconnaissance. Essentially, the unit area method is the fractional-code method applied on a larger scale than has been the practice. It is unique in that it applies fractional code notations to land units of 200 acres or more, employs aerial mosaics (scale, 1 : 24,000) as base maps, and embraces items pertinent especially to land planning.

In the present undertaking, which covers the greater portion of the Tennessee River Basin, six major types of land are recognized: namely, (1) agricultural land, (2) forest land, (3) land used for recreation, (4) land occupied by rural settlements and villages, (5) land occupied by urban developments, and (6) land occupied by manufactural and mining enterprises. The last four are not studied in detail. They are merely delimited on the field mosaics and identified by single Arabic numerals. Forest areas of 200 acres or more are classified only on the basis of certain natural elements—slope, drainage, erosion, stoniness of soil, rock exposure, soil depth, and soil fertility. Agricultural areas are classified on the basis of five conditions: namely, (1) slope, drainage, erosion, stoniness of soil, rock exposure, soil depth, and soil fertility; (2) major agricultural land use, agricultural emphasis, field size, proportion of idle land, and quality of farmsteads and equipment; (3) agricultural quality as indicated by the present physical conditions of the land; (4) effectiveness of present agricultural use of the land as reflected in the economic conditions of the people; and (5) a summary appraisal of the cultural and natural conditions.

The legend employed in this project contains a total of eighty-four items, each of which was selected and defined after extensive experimental application and testing in the field under a wide variety of conditions. Some definitions have been accepted; others have been left open for reexamination and retesting, the object being to establish classifications which will apply to the entire Valley.

As it now stands, the unit area method contributes to both geography

and land planning a means of securing a relatively accurate, quantitative portrayal of the occupance pattern. This portrayal is achieved rapidly and at a relatively low cost. It characterizes the observable features of the landscape and appraises them in terms of their relative quality. The characterization is an accepted geographic procedure. The field appraisal is a significant enrichment of this procedure. The portrayal is quantitative and complete in areal coverage. The minimum unit of 200 acres permits the retention of considerable detail and a high degree of accuracy. At the same time, the use of so large a unit and the use of aerial mosaics as base maps permit a greater speed of operation than has heretofore been possible in quantitative work employing the fractional code. The fact that the development of this method was motivated by the requirements of land planning does not detract from its contributions to geography. In reality, this application of a geographic procedure to practical problems of land planning augments its contribution, because land planning is a fundamental social end toward which geography as an applied science inevitably progresses.

EDWIN N. HUMPHREY. (Introduced by C. W. Thornthwaite.)
Oblique Cylindrical Equal Area Projections.

A. Introductory Remarks Concerning the General Classifications of Map Projections:
   1. According to the developable surface
   2. According to the method of projection
   3. According to the properties of the projection.

B. Equal Area Projections:
   1. Preservation of area in conventional projections
   2. True geometric equal area projections
   3. Uses of equal area projections.

C. Cylindrical Equal Area Projections:
   1. Considered as special cases of the conic projections
      a. With two standard parallels
         1. Secant cone
         2. Albers Equal Area projection with two standard parallels.
   2. In their various positions
      a. Normal
      b. Transverse
         1. Meridional
         2. Oblique
            A. Geometric projection with rule and compass
            B. Geometric derivation of formulae
            C. Derivation of formulae for the oblique Behrmann.

D. Properties of Oblique Cylindrical Equal Area Projections:
   1. Area
   2. Shape
   3. Scale
   4. Bearing
   5. Ease of drawing
   6. Advantages in representing distribution and relative location
   7. Disadvantages of the projections
   8. Comparison of the Oblique Behrmann with the ordinary type.

E. Maps of Northwestern Europe constructed with an angle of obliquity of 70° and tables of the rectangular coordinates of the intersections of meridians and parallels.

F. A few suggestions for other maps constructed on these projections.

PRESTON E. JAMES.

Regional Planning in the Jackson Hole Country, Wyoming.

The present arrangement of the occupance in Jackson Hole, Wyoming, is the result of the impact of two opposed plans of land use. One plan calls for the progress of settlement and the shift from cattle ranching to more intensive forms of economy. The other plan looks forward to the removal of the settlement already established, the return of the area to its natural state, and the maintenance in it of herds of wild game. Neither of these plans has been able entirely to dominate; the resulting impact has left its visible record in the landscape of the area, and has created an economic and political situation for which a compromise is difficult to discover.

MARK JEFFERSON.

Motors as Criteria of Wealth in Europe, 1934.

There is much greater use of motor cars of all kinds in the "North Sea" countries than in the fringe of peoples that swings around them from Mediterranean to the Baltic, and very little in the side of Europe toward Asia—Poland, Soviet Union, and Balkans. Interesting contrasts occur between England, France and Germany, as well-to-do, wealthy and poor nations by this criterion when 1934 began.

Sidelight is shown by glancing at the use of the telephone, conceived of as a not expensive means of communication. While preserving the general group relations of the motor study, the reversal of the relations between some of the countries is notable.

J. C. JENSEN (American Meteorological Society).

Evaporation and Rainfall Studies in the Northwest Minnesota Lake Region.

This investigation was an outgrowth of studies on drought conditions begun during August and September, 1934, and was made possible by a grant of funds from the American Philosophical Society.

In the previous investigation, which was reported to the American Meteorological Society at Pittsburgh in December, 1934, it was shown that the precipitation from local thunderstorms was greater under drought conditions on the lee side of lakes and irrigated areas under observation than on the windward side. The theory was proposed in explanation that air rising into a thundercloud from such surfaces should carry larger amounts of moisture and be at a lower temperature, resulting in rain formation at a lower cloud level and also decreasing the re-evaporation of rain falling through rising air currents of low humidity.

In the 1935 investigations, recording and indicating instruments, including barographs, thermographs, recording hygrometers, and rain-gauges were installed at selected points in northwestern Minnesota where a lake area of 83 square miles is exposed to evaporation in Ottertail and adjacent counties. Data were obtained bearing on two aspects of the problem: first, to determine whether the rainfall was appreciably larger on one side of the area than on the other and whether such differences bore any relation to the storm paths as determined by microbarographic records and rain-gauges. The second was to obtain data regarding the contribution of the lakes to the humidity of the air passing over them under semi-drought conditions.

Records were obtained on only 5 or 6 storms which could be classified as "local" thunderstorms. Their general path was northeastward, and the precipitation records showed the heaviest rains in the eastern and northeastern sectors of the observed area, the total differences in some instances being as much as 100%. The number of storms studied is insufficient to give conclusive results, but the variations do support the observations of the preceding year.

During a ten-day period of hot south winds in August, numerous sling psychrometer and wind velocity readings were taken at points located north and south of lakes 1 to 7 miles in length. From these data the absolute and relative humidities were computed. By the use of Fitzgerald's equation, $E = (p_s - p_o)\ (1 + 1/2w)$, where E is the evaporation in inches per minute, p_s the saturated vapor pressure at a given temperature, p_o the observed vapor pressure at the same temperature, and w the velocity of the wind in miles per hour, it was found that the amount of water carried away by the wind each day agreed closely with the observed evaporation from the lake, provided the arbitrary assumption is made that the absolute humidity decreases linearly from the surface to an altitude of 500 feet, above which the air is assumed to carry no more moisture than above adjoining fields.

The moisture content of winds blowing over a lake surface was 25% greater than the simultaneous value on the windward side of the lake. It is maintained that these results give definite support to the utility of lakes and ponds as a means of increasing the probability of rainfall from local thunderstorms and of decreasing the amount of re-evaporation of falling rain, which caused the "dry" thunderstorms so prevalent during the summer of 1934.

WELLINGTON D. JONES.

Alternative Ratios for Crop Isopleth Maps.

Five rice maps of Northeast India are presented, each based on the ratio of area in rice to some other measurable item, specifically to (1) total land area, (2) gross area cropped, (3) net area cropped, (4) area in cereals and pulses (Engelbrecht's "getreideflache"), and (5) population. These five maps show different ratio values for any given spot, and the ratios mapped display different areal patterns.

Question 1. Which map best shows the prominence or importance of rice in the landscape? Quite clearly the map of the ratio of rice acreage to total land area is best for this purpose.

Question 2. Which is the best map to determine relative area under rice as between two or more localities? Again the map based on total land area is best, since this is the only map with a constant base.

Question 3. Which map is best to show the importance of rice in the crop combination? For this purpose I should select gross area cropped. In the United States, where double cropping of fields rarely is practiced, net area cropped serves just as well, since net area cropped equals gross area cropped. In India, where a good deal of land carries two crops a year, gross area cropped must be employed. Incidentally, in India this base is approximately equivalent to area in farms in the United States.

Question 4. Of what utility is the map based on net area cropped? One may wish to show how this section of India compares with areas outside India, say in the United States Corn Belt, in the proportion of the cropped land devoted to an important cereal. This map serves for the India side of the comparison.

Question 5. Why consider employing area in cereals and pulses as a base? My objection to this base, which Engelbrecht argues is best, is that "getreideflache" is less true than gross area cropped as a base for showing the areal importance of any given crop in the crop combination.

Question 6. "What is the utility of the map showing ratio of area in rice to population?" This ratio gives a rough measure of rice production as compared with the population needing rice or some other food cereal for consumption. As such, it seems to me to have significant value in regional analysis.

HENRY MADISON KENDALL. (Introduced by Stanley D. Dodge.)

Some Notes on the Population of France.

Though the total population of France has maintained a slow rate of increase for the period 1801–1931, this condition is not reflected in all parts of the country. Certain Departments show continued growth, others show partial decline, while the larger number have reached a position of relative stability.

The occupational character of the population has changed markedly from dominantly agricultural to about equally agricultural and industrial. It has frequently been stated that the population growth has occurred in industrial areas and that there has been a decline in agricultural areas. This study shows that such a statement is quite inadequate and in part untrue.

J. B. KINCER.

Organization and Work in Climatology and Agricultural Meteorology in Great Britain, France, the Scandinavian Countries, Poland and Russia.

The several European climatological organizations have many features in common with that in the United States, but there are some rather important differences. With two exceptions, Norway and Russia, the services are cooperative, that is the Government supplies the instrumental equipment and the observations are taken daily and monthly reports rendered by public-spirited citizens without monetary remuneration. In Norway and Russia the observers are paid nominal salaries, about $2.00 a month, on the assumption that, from the viewpoint of administrative supervision, better service can be maintained thereby. Opposed to this view, in other cases, it is maintained that a cooperative service is preferable whereby there can be a selection of observers interested enough in the work to carry on for the mere love of it, together with a personal satisfaction in the knowledge that a patriotic duty is performed thereby.

In Europe, station classification, with regard to instrumental equipment and data collected, is quite unlike that in the United States. Stations are designated "climatological" and "rainfall," the former having equipment for observing both temperature and precipitation, and the latter rainfall only. Probably, on the average, about 25 per cent of European stations fall within the "climatological" category, while in the United States an equal proportion, or greater, are fully equipped.

In Russia the Soviet officials are doing extensive micro-climatic work, with special reference to subtropical fruits, to determine areas suitable for their production. During the past two years they have established 600

special stations in subtropical regions of the Union and are planning an additional number within the next year. From records obtained from these they propose to construct micro-temperature charts, delineating areas most susceptible to frost and establishing other important climatic characteristics, as a guide in their planning and planting operations.

It was hoped while in Russia that opportunity would be afforded to visit the regions in which "shelter belt" tree planting has been practiced for many years, but press of time did not permit this. However, the the climatic effects of their forestations were discussed with officials of the Meteorological Office, conversant with the facts, and the conclusions may be summarized briefly as follows: The shelter belts have proved materially beneficial in retarding wind movement over the Plains, reducing the rate of evaporation both within and near the forests, and in the catching and holding of snow, that otherwise would have blown away, the melting of which supplies needed soil moisture not obtainable by any other means. In such things as these, it was emphatically stated, the shelter belts have proved their worth. On the other hand, it was said, there is no evidence whatever of an increase in rainfall, due to tree planting, either within the forests themselves, or in their vicinity. Even very careful measurements of atmospheric humidity, before and after passing over the forested areas, show no appreciable increase in the moisture content of the dry air either within the forests themselves or to the leeward. There was also no important temperature effect, except that on the leeward side, where the air movement is reduced, radiation is more effective in lowering nocturnal temperatures near the surface of the ground, which is more frequently detrimental than beneficial. This, of course, is the operation of well known inversion processes.

In other words, careful investigations show, the Soviet officials say, that tree planting is effective only in modifying existing climate in the ways mentioned, without in any way basically changing it, but the results thus obtained are well worth while. This confirms, without reservation, opinions repeatedly expressed by officials of the United States Weather Bureau with regard to shelter belt plantings in our own Western Plains.

J. B. KINCER.

Veteran Cooperative Observers of the U. S. Weather Bureau, and the Organization of Climatological Observations in the United States.

Early weather records in this country were made in a spasmodic manner by uncoordinated agencies and it was not until 1870, when The Congress passed a joint resolution requiring the taking of meteorological

observations at all miiltary posts, that climatological work in a systematic way was undertaken.

Twenty years later, in 1890, came the birth of the Weather Bureau, as it now exists. In that year an Act of Congress established the present institution, transferring all official meteorological work, theretofore handled by several uncoordinated agencies, to the Weather Bureau in the Department of Agriculture. This Act provided, among other things, for "the taking of such meteorological observations as may be necessary to establish and record climatic conditions in the United States."

In giving this order for collecting *sufficient* records to establish the climatic characteristics of the United States, The Congress probably did not realize the magnitude of the undertaking. While literally thousands of stations were necessary, the funds available for the inauguration of the work were wholly inadequate to finance the project, if the observers were to be compensated for their work.

Under these limitations the Weather Bureau set about to organize a corps of cooperative observers, the bureau to supply the instrumental equipment and the observations to be made by public-spirited people without pay for their services. Expansion was rapid and in a comparatively short time an extensive network of stations was in operation, finally reaching a total of more than 4,500.

In many ways this is a remarkable service. We can hardly conceive of nearly 5,000 people, representing nearly every county in the United States, freely giving of their time to make weather observations and reports every day in the year, year after year, some of them for 30, 40, and even more than 50 years. If for each of these, on the average, there should be required, say, a minimum of 15 minutes a day to take and record the observations, answer questions about local weather, and make the regular monthly reports, the total of time contributed to the Government for the entire service would amount to some 15,000 full days of work each year. We know of no other Government cooperative enterprise that even remotely compares with the Climatological Service of the Weather Bureau; that is, where considerable of the time of thousands of people is required every day in the year, even including Sundays and holidays, for long periods of time.

An examination of the roster of the Bureau's cooperative observers discloses some interesting facts with regard to the period of time many of them have served continuously. Some 300 have to their credit 25 years or more, 69 more than 40 years, and 3 have passed the half century mark as cooperative observers. Those with more than 50 years of service are:

Mr. Elwood Kirkwood, Mauzy, Ind.; Mr. Edward L. Redfern, Taunton, Mass.; and Mr. William C. Harris, Dover, N. J.

There are more than 300 women observers, 3 of whom have served more than 40 years. These are: Miss Laura B. Knapp, Plymouth, Mass., 49 years; Miss Alice B. Scudder, Moxee, Wash., 43 years; and Miss Annette Koch, Logtown, Miss., 43 years.

LESTER E. KLIMM.

A Revolution in Land Utilization and Settlement Forms: Clare Island and Inishturk, Irish Free State.

These two islands are an interesting example of what may be accomplished toward readjusting the system of land use and land ownership to fit the physical environment. The first edition of the 6-inch Ordnance Survey Maps—that for 1838—shows crowded agglomerations of houses, few fences, and a chaotic system of land use. Both islands were overpopulated. The potato famine of 1847–48 and the consequent death and migration decreased the population on both islands, but did nothing to reform the land system. Between 1890 and 1916, the Congested Districts Board for Ireland bought both these islands, laid out continuous farms of economic size running in strips from the mountain common to the sea, so that each farmer had a portion of the better land resting on glacial drift and access to pasture. The common and each farm were fenced and a house was built on each farm, thus breaking up the former agglomerations. The holdings were then sold to the former occupiers on the basis of time payments which could be earned from the land. The current editions of the 6-inch maps show the result of this resettlement in an orderly pattern of settlement and use which is neatly adjusted to the terrain, the distribution of drift, and access to the sea.

FRED B. KNIFFEN.

An Approach to Culturogeographic Regions.

This paper sets forth the results of the first step in an attempt to delineate the several culture regions of Louisiana by means of a quantitative consideration of the cultural forms of the landscape. Since the purpose of the study was to identify rather than to describe culture regions, it was necessary to consider only those forms possessing diagnostic value, in this case house types, land patterns, and the character of the individual etablishments. The first, house types, is here considered.

The detailed analyses of several hundred houses gave some clue to the combinations of roofs, porches, doors, and appendages to be expected, and, more important, they revealed the significant variants. A shorthand

method for the rapid recording of the significant features of houses was developed.

The state was thoroughly traversed, some 15,000 houses being recorded. Urban centers were excluded, since they frequently reveal extra-regional influences. Analysis of the field sheets revealed about twenty significant house types, and about fifty sub-types. Each sheet was summarized and reduced to percentages, which were plotted on graph paper. From the graphs were selected the several types showing sufficient numbers and localization to be of value with respect to regional differentiation. Their areal distribution, shown by a series of isoplethic maps, revealed several nuclear cores, distinct with regard to house types, with intervening "mixed" areas, all of which is expressed on the final map.

EARL E. LACKEY. (Introduced by Nels A. Bengston.)

An Annual Variability Series of Isocrymal Maps of the Great Plains of the United States.

The technique in constructing this series of variability frost maps follows that pursued in the corresponding study of Nebraska presented at the meeting of the Association of American Geographers last year.

The twenty-, forty-, fifty-, sixty-, and eighty-percentile maps for both spring and autumn will be presented. The isocrymes in the twenty-percentile map for spring will indicate the date on or after which the last killing frost of spring has occurred 20% of the time. The isocrymes on the other four maps for spring are to be similarly interpreted. A corresponding series of five maps will show the variability in the dates of the first killing frost of autumn on the Great Plains.

The series should be valuable in showing the poleward advance of spring and equatorward retreat of summer as it has occurred at different percentages of the time during which records have been kept.

JOHN LEIGHLY.

Empirical Investigations of the Extremes of the Annual Temperature March.

Climatologic data commonly define the annual march of temperature by monthly means. From such data the dates of the maximum and minimum can not be identified more closely than to the nearest month, the temperatures of the extremes can be defined only by the means of the extreme months, and the annual range of temperature be computed only as the difference between the means of the warmest and coldest months. A rational discussion of the annual march requires, however, a closer definition of these quantities.

This paper describes graphic charts which yield, from monthly means, approximations to both the dates and the temperatures of the extremes of curves of mean daily temperature. The date of the extreme of a sine curve interpolated through the mean temperatures of three months at the maximum or minimum is sufficiently close to the date of the extreme of the curve of mean daily temperature to be generally applicable for climatologic ends. The charts described, computed separately for four winter months and four summer months, date the extremes of such interpolated curves directly when entered with the differences between mean temperature of the extreme month and of the months immediately preceding and following it.

The temperatures of the extremes of the curves of mean daily temperature may be found by assuming that the march of temperature during the extreme month is some analytic curve, the integral of which, taken over the length of the month, is the mean monthly temperature. The date of the maximum or minimum being given, the value of the maximum or minimum can be computed from the equation of the assumed curve. Two charts for performing this computation are described, based respectively on the assumption that the march of temperature during the extreme month is (1) a sine curve and (2) a parabola. They give a correction to be added to the mean temperature of the extreme month to obtain the temperature of the extreme of the assumed curve of daily temperature, when entered with the differences between monthly means mentioned above. Of the two charts, the one assuming a parabolic form of the curve of daily means is to be preferred.

Results of the use of the charts are illustrated by maps of the dates of maximum and minimum of the annual temperature march in California, and of the annual range of temperature in central California and adjoining parts of Nevada, in the construction of which the data from a large number of coöperative climatologic stations were used.

HENRY M. LEPPARD.

Land Utilization in Scotland (Invited Paper.)

The agricultural output of Scotland amounts to about $200,000,000 annually, 80 per cent of which is derived from live-stock and live-stock products. Though the country has a land area of only 30,000 square miles, farming is marked by a high degree of regional specialization. Records extending over the past half-century indicate a decline in the acreage of land in farms, an increase in land in permanent grass at the expense of arable (cultivable) land, and a shrinkage of more than 20 per cent in acreage actually under the plow.

The number of sheep in Scotland has remained fairly constant during the period indicated. The number of cattle has registered a small net gain due to an increase in dairy animals which has rather more than offset a loss in other classes. Even dairy cattle, however, have failed to maintain earlier ratios to human population.

In addition to dealing with the present uses of land and the trends of recent decades the paper will report on a number of investigations into land utilization and related subjects now being carried on by Scottish authorities, particularly those having to do with marketing and the profitableness of farming.

K. C. McMURRY.

Problems of Land Utilization.

1. Outline of land utilization studies in Michigan during past twenty years.
2. Application of inventory materials resulting from such studies to actual problems of land use planning and land administration in Michigan.
3. Problems of inventory and use of inventory data in the Federal Land Program in Michigan.
4. Critique of methods, procedures and accomplishments in land inventory and administration.
5. Function of the geographer in land inventory, land use planning, and land administration.

HOWARD H. MARTIN. (Introduced by Frank E. Williams.)

Geographic Regions of Karafuto.

Temperature and rainfall differences throughout Karafuto are slight. Approximately 90% of it was originally covered with forests of pulpwood, the leading species being toda-matsu (fir) and ezo-matsu (spruce). The regional divisions, therefore, are based upon relief, soils, and stage of exploitive or cultural development.

1. *Suzuya-Rutaka Valley.*—This lowland plain is the dominant region in population, agriculture, and urban development. It contains 40% of Karafuto's 300,000 population. Of the 10,000 farm households in Karafuto, 80% are concentrated here. Successful crops include hay, oats, potatoes, peas, and buckwheat. Some 5,000 Holstein cows are kept for dairy purposes. Toyahara, the capital, Odamari, the chief port, and the cities of Ochiai, Sakehama, and Rutaka contain about 100,000 people.

2. *Southeast Highlands.*—This region includes two parallel mountain ranges separated by a swampy lowland; originally pine-forested it has been

cut over and virtually abandoned. Some tamarack remains in the swampy areas but not over 2% of the virgin timber is left. Population is scant, fishing unimportant, and agricultural land negligible.

3. *South Karafuto Mountains.*—This region was originally heavily forested. Most of the timber has now been logged off, destroyed by caterpillars, or damaged by forest fires. Not over 5% of the original stand remains. The west coast pulp mills at Tomarioru, Noda, and Maoka are fed by pulpwood rafted down from the north. Fishing and fish canning at Maoka and Honto are important. A scattered population along the narrow coastal plain is supported by fishing and garden-farming. A few coal mines furnish fuel for local use. The region's population is approximately 40,000.

4. *North Karafuto Mountains.*—This is the region of present active timber exploitation, and contains the largest remaining stand. Pulpwood cut in winter is dragged to the coast or rafted down the rivers to Esotoru and to the new boom town of Shisuka. It is estimated that the pulp supply will last forty to fifty years. Coal mines and coastal agriculture complete the resources. The population is about 50,000.

5. *Northeast Highlands (Tohoku Mountains).*—This rough and heavily forested area, with fir and spruce on the uplands, tamarack on the lowlands, is the region of future timber exploitation. Of its pulpwood 80% is still untouched. Its population includes a few transient timber workers and fishermen.

6. *Horonai Basin.*—This V-shaped plain, covered with so-called Sakhalin tundra, stretches from Taraika Bay to the Russian border. Except for the city of Shisuka this is a region of native population. Wandering tribes of Gilliak and Orokko carry on a semi-nomadic existence, grazing herds of reindeer, supplemented by fur-hunting and fishing.

ERIC R. MILLER (American Meteorological Society).

Brückner's Cycle in the United States.

The earliest notice of a 35-year cycle in meteorological conditions is more than 300 years old, namely in Francis Bacon's essay "On the Vicissitudes of Things" which appeared in 1625. It was established on a scientific basis through the researches of the Swiss climatologist, Eduard Brückner in 1890.

The present paper is devoted to the latest cycle, 1895–1930, and is restricted to rainfall and to the United States. A special method, that of graphing the "accumulated departure from normal" is employed to bring out the trend of rainfall. When the rainfall of a group of years as a whole is above normal there are always some years with rainfalls below

normal, and vice versa. The graphs used here clearly bring out the trend, falling when the rainfall is below normal, rising when above. Another feature of the present study is that the average rainfall for whole States, based on about 100 observing stations in each State, is used. Hitherto the studies of Brückner's cycle have been based on the rainfall at single places. The irregularities due to local downpours have obscured the trend of the cycle.

The direct cycle appears everywhere except in States watered by the winter rainstorms from the Gulf of Mexico. There the cycle is reversed in phase, but of as great amplitude.

SIDMAN P. POOLE. (Introduced by Frank E. Williams.)

Settlement Patterns of Southern Brittany.

Jutting into ancient Brittany on the southwest is the Gulf of Morbihan. The thousand or so square kilometers of land adjacent to it, with their ninety thousand inhabitants, constitute the Morbihan Littoral. This is a land of canyon-like roadways and island-studded estuaries, of gray-stone homesteads and brown-oak fishing craft. Here only, in all Brittany, does the ocean's mildness make possible the cultivation of the vine. Here the herdsman is also a fisherman, and the reefer of sails turns readily to guiding a plow.

At the heart of geographic studies is the description and analysis in terms of the environment of the settlement patterns which man has evolved in each area. It is purposed here to do this for the littoral cantons of the Morbihan. For analytical purposes the settlement pattern may be surveyed under three heads; transportation, buildings and fields. To each of these is associated such structures and activities as are functionally related to them.

The network of roads, both national routes and *chemins,* and of the railroads, present readily discerned patterns, intimately related to coastal relief and drainage features and to the historical background and extraneous military and political policies that have left their imprint on the area. Map studies best illustrate the skeleton and flesh of these patterns.

Expressive of the personality of the Morbihan shores is its pattern of fields. Grain fields, orchards, market gardens, vineyards, pastures, all are found here, resulting in a somewhat unique modification of the natural landscape. Small and highly irregular fields bordered with walled and wooded *chemins* are typical of the region. Rock outcrops, shore irregularities, changes in soil types and relief considerations as well as old legal customs and the feudal method of strip cultivation are all impressed on this field pattern.

The gray-granite, steeply pitched and thatched roof home of the peasant-fisherman is an epitome of the region. Grouped into almost formless hamlets, along the usually younger *chemins,* they reflect in their construction, uses, and location the materials, climate and economic activities of the region. Even the ruined medieval castles or neolithic cromlechs and dolmens appear to fit naturally into the picture.

W. E. POWERS* AND CHAS. H. BEHRE, JR. (*Introduced by W. H. Haas and Chas. H. Behre, Jr.)

The Origin of South Park, Colorado.

Results of detailed studies during the past three field seasons make possible the accurate dating of the physical events that gave South Park its present form. The studies, cooperative between students of physiography and of bed-rock geology, were made possible through a Penrose Grant from the Geological Society of America. Collaborators are Messrs. J. T. Stark, J. Harlan Johnson, A. L. Howland, and Don B. Gould, as well as the authors.

The Park was first blocked out as a result of Laramide (late Cretaceous and early Tertiary) orogeny, by which resistant Paleozoic and older rocks west of the Park were uplifted into the present Mosquito Range, and were partly eroded. The soft sediments furnished by this erosion underlie much of the present Park basin. A late incident in the process was thrust faulting from the east, which raised the more resistant rocks now making up the Front Range. Differential erosion subsequently etched a wide valley in the soft rocks between the two ranges. In this valley sediments and lavas of Oligocene age were deposited. Temporary ponding, perhaps by these leaves, yielded a Miocene(?) lake or lakes in which fossiliferous sediments accumulated, and this general type of sedimentation continued into the earliest Pliocene. The above dates are confirmed by fossiliferous deposits but the collections merit further study. Warping and block faulting accentuated still more the depressed area forming the Park.

In Pliocene time a southward drainage had truncated all of the pre-Pliocene rocks; it led from Kenosha Pass, at the head of the Park, into what is now the Badger Creek valley, and the resulting strath and its border sediments are still excellently preserved immediately south of the Park. Later the Park drainage was diverted, apparently through (1) headward cutting and beheading by the South Platte, essentially along its present valley, and (2) uplift at the southern end of the Park, athwart the Badger Creek drainage. That uplift is recorded in the drainage history, as well as by certain fanglomerates.

Subsequent history relates to glaciation. In an early glacial (Kansan?) stage, extensive rock terraces, with deposition limited to the mountainward slopes, were developed. Three substages (the "Como-levels") can be recognized, especially in the northwesterly part of the Park, near Como. No moraines are preserved that can be definitely connected with this stage.

Illinoian(?) and Wisconsin times were marked by the formation of moraines, as well as of outwash aprons, merging into rock terraces or pediments. These flat surfaces are now the dominant features of low relief in the Park. Above them rise, like islands, remnants of the Como levels or of higher uplands etched out of older rocks.

EDWARD C. PROPHET. (Introduced by K. C. McMurry).

Types of Recreational Land Use: A Study in Classification and Definition.

Each student of recreational land use has had to develop a series of terms to identify the various ways in which recreational activities express themselves in the landscape. Fortunately most students have chosen either the same terms or very similar ones in referring to the same objects. However, most of the workers have been interested in limited portions of the subject; so that no one has attempted to identify, classify, and summarize the types of recreational uses of land. Feeling a need for such a general classification of the uses and their expression in the landscape the following summary is submitted:

A. Large Scale Projects—usually extensive use of 'wild land.' Cheap priced land not otherwise used except for miscellaneous conservation uses.
   1. Hunting and Fishing lands
      a. Private Ownership
      b. Governmental Ownership
      c. Uncontested Trespass—absentee ownership so used by trespassers for hunting.
   2. Aesthetic uses. Usually government owned. Used by lovers of nature, camera hunters, campers. New York State Adirondack Mts. project and Wilderness Park in Michigan are examples.
   3. Recreation Clubs. Summer resort development on limited areas but with a large area of wild land under same ownership to serve as 'bait' in making a success of a real estate promotion scheme.
   4. National Parks. Tourist and resort centers on a background of scenic splendor. Recreational use combined with idea of preserving for all time special natural features.

5. State Parks. Same as National Parks but usually on a smaller scale. Tourist camp use usually dominant.
6. Recreation Parks. A new idea, a combination of Coney Island and a National Park. A large area with special entertainment features constructed on many spots. Poor land within relatively easy driving distance of population centers. Waterloo and Barry Projects in Southern Michigan are examples.

B. Small Scale Projects—intensive use of wild or poor lands.
1. Summer or Winter Resorts—water features often locating factor.
2. Summer or Winter Hotels. This would include hotels located near mineral springs.
3. Organized Camps. Recreation and study combined as means of attracting visitors. Examples, Y. M. C. A. and Y. W. C. A. camps, Music camps, Religious camps.
4. Tourist Camps. Overnight cabins on main routes of travel; may or may not be in wild land areas.

C. Small Scale Projects—intensive use but located in well settled areas. Located on relatively high priced land suitable for other uses and often withdrawn from other uses.
1. Golf Courses.
2. City Parks.
3. Play Grounds. Very small areas but the most intensively used areas listed in this classification.
4. Cabin Camps. Same as tourist camps listed above.
5. Roadside Picnic Grounds. New development along State and national highways. Stops a trespass problem or alleviates it.
6. Tourist Camps, either public or privately owned. In or near population centers or on main routes of travel.
7. Tourists' Hotels and Lodging Houses. Usually in combination with other basic uses of the land and secondary in importance.

The classification is arranged so that new uses can easily be added without materially reorganizing it.

Some confusion has resulted in efforts to measure the relative importance or value of many of the recreational uses of land due to the fact that various units of measure have been used. On the basis of acreage only the large wild land projects appear significant, while on the basis of the amount of money spent by the recreationalist the tourist or the resort uses would

stand out as most important. It appears that some other index is desirable for general comparative purposes, so the author suggests that man-hours of use may be suitable. This would express recreational use of land in terms of hours of use or enjoyment by man. In other words, it would express it in recreational terms.

MALCOLM J. PROUDFOOT. (Introduced by Chas. C. Colby.)

A Statistical Test of the Adequacy of Traverse Lines as a Means of Sampling Unit Areas.

This test was based on a 134-square-mile segment of a four-mile wide cross section of the Valley of East Tennessee. The area was mapped during 1934 by the Land Classification Section of the Tennessee Valley Authority. The map of this area was divided into units of one-square-mile. Each square-mile was planimetered separately and the percentage of each taken by ten types of land use and physical conditions was determined. These percentages were taken as absolute; representing the true condition of each square-mile. Then traverse lines at half and quarter-mile intervals were run across the identical square mile units. Percentages of the same ten types of land were determined from their linear distances along each traverse line. These percentages did not exactly correspond to those obtained by planimeter measurement. The traverse lines had sampled the square mile units, and of necessity only approximated the truth obtained by planimetering the entire area of each unit.

The purpose of this statistical test was to determine the relationship between the sample traverse percentages, which approximated the truth, and the true percentages obtained by planimeter measurement. This relationship was measured in terms of coefficients of correlation; a statistical device for measuring the reliability of just such a relationship. It was determined, in approximate harmony with work done by J. M. Trefethen of the University of Wisconsin, that when the total length of the traverse line or lines sampling any unit area is 80 or more times the average field widths intercepted along these lines, the following coefficients of correlation were obtained: (a) for types of land use and physical conditions comprising 10% of the unit area tested, .8000 plus; and (b) for all other types of land comprising 10 to 50%, proportionally higher (coefficients of 1.0000 indicate a perfect relationship).

This test provides a statistical basis for the adequacy of sampling unit areas with traverse lines under varying field-size conditions. In using traverse lines to obtain quantitative field data: (a) determine the average field widths of the area in question; and (b) run traverse lines with a total length at least 80 times that of the average field width. If this rule is ap-

plied, this test has demonstrated that accurate results will be obtained for any type of land comprising over 10% of any given unit area.

CASPAR RAPPENECKER. (Introduced by O. D. von Engeln.)

The Moneague Valley, Jamaica: Site of a Temporary Karst Lake.

Moneague Valley, situated in St. Ann Parish, Jamaica, B. W. I., is a roughly oval depression, with diameters of five and four miles, in which a lake appears at irregular intervals. The lake development is a karst phenomenon. Lakes are not uncommon features in karst areas but the Moneague Valley occurrence has especial interest because the lake phase frequently lasts long enough to interfere seriously with, and even alter, the use to which the land of its basin would normally be put. The occurrence is of special interest at this time for the lake is still present.

The lake began to develop in late August, 1933, following a period of heavy precipitation. The subsequent history of fluctuation in level and area of the lake closely parallels the rainfall distribution. The greatest height was attained in late November, 1934, at which time the lake was nearly 200 feet in depth and covered an area of about four square miles.

That the lake should appear and that the level of the lake should rise with increases in the volume of precipitation could be expected. But the fact that there is a marked lag between the time of increase in rainfall and the rise of the lake level, together with certain curious associated phenomena, indicate that the response is not direct. A study of the available rainfall records shows that a lake may be expected to develop if the rainfall in the region materially exceeds 100 inches a year. An exception is noted in that no lake appears if the precipitation of more than 100 inches is evenly distributed throughout the year. Then normal underground drainageways apparently can dispose of it as it comes.

Land utilization and the distribution of population throughout the plateau are related to topography and rainfall. On the uplands agriculture is an hazardous undertaking in view of the long droughts which are not infrequent. Plots cultivated by natives to supply so-called "ground provisions" and such tree crops as citrus fruits, coffee, and pimiento occupy some of the upland areas. Grazing is also important in favored localities. But zones of steep slope are common and there are large tracts where the grey, cavernous limestone outcrops supporting only native vegetation in small pockets of residual soil. The large valley bottoms, where thicker and richer soils have accumulated and where surface drainage is usually present, are sites of banana and sugar estates. The Moneague Valley, however, perhaps because it is a site where a karst lake develops, is an exception in that it is used only for pasture and native ground provision cultivation.

GEORGE T. RENNER.

Recent Developments in National Regional Planning.

The present $4,000,000,000 Federal works program represents, not an increase in public expenditure, but rather a shift in responsibility from impoverished state and local governments to the Federal Government. In June, 1933, the Tennessee Valley Authority was created as a gigantic Federal experiment in a region too poor to pay for local improvement. At the close of the 74th Congress, there were proposed or pending a dozen bills seeking to create additional federal corporations for regional development. Should all these proposals become law, more than half of the territory of the nation would, for purposes of resource development, come under the control of the Federal Government. This eager reaching for federal monies and benefits comes, interestingly enough, simultaneously with the revival of the issue of states rights, and a growing resentment toward federalism. For the first time, allotments for the majority of public works in this country has been concentrated under one office, a circumstance which has revealed sharply the need for national planning. The United States, however, is too large and varied to permit detailed national planning from any single vantage point. Hence, some measure of devolution of planning to the localities is needed.

The natural clustering of resources and problems demanding treatment almost compels some sort of regional approach to their solution. The states are inadequate to meet this need because most of the major problems are interstate in character. Early in 1935, the President expressed a wish that regionalism in planning and development be studied and clarified. Accordingly the National Resources Board set up a technical committee, consisting of an engineer, a geographer, and two political scientists. The Committee's problem did not reduce to the simple task of dividing the country into regions, but involved considering regionalim in terms of (a) the clustering of resources and problems requiring planning treatment, (b) manifestation of sectional sentiments and climates of opinion, (c) administrative considerations in the devolution of national planning, (d) division of costs for public works, among different levels of government, and (e) the nature of developmental project-areas. In the course of the Committee's work it became apparent that the following were necessary:

(1) A permanent National Planning Board to serve as part of the President's immediate staff.

(2) Some eleven regional planning commissions, based upon federal and state participation, to be entrusted with formulating regional plans; these plans to be routed through the National Planning Board directly to the President.

(3) A permanent National Development Administration to carry out planned programs.

(4) To defer the creation of additional federal corporate regional authorities, until a necessity for them should grow out of prior planning.

JOHN KERR ROSE. (American Meteorological Society.)

Some Intercorrelations among Climatic Variables in the Corn Belt.

Most of the correlations are for monthly periods, most of them during the growing season. The period of years covered commonly exceeds 20, ending in 1932.

Part of the investigation is concerned with intercorrelations between factors coexistent in time. For example, an attempt is made to answer the question as to how likely an abnormally hot July is also to be an abnormally dry July.

Another investigation delves into the possibility of significant correlations between climatic factors during different periods of the growing season—i.e., whether or not May precipitation correlates significantly with July temperatures.

The coefficients obtained are mapped by means of isopleths. Particular attention is given to such areal differentiation as is found, and possible reasons for it are discussed.

RICHARD JOEL RUSSELL.

Deltas of the Mississippi River.

Mississippi River sedimentation has been the dominant agency controlling the geological history of the northern coast of the Gulf of Mexico throughout at least Cenozoic time. While the intricacies of earlier history are known only vaguely, those of the Quaternary are becoming increasingly clear and reveal a sequence of deltas occupying roughly one-fifth of the State of Louisiana. These extend along the entire coast and converge to a point well over 100 miles inland.

The older deltas preserve many significant floodplain forms, such as meander patterns, meander scars, natural levees, abandoned channels, and soils derived from river silt. Their surfaces are tilted southward, and with considerable contact irregularity pass beneath coastal marsh deposits. Northward they are more and more elevated above the incised valley now occupied by the Mississippi floodplain.

The younger deltas are related to the existing floodplain level and occupy an eastern position on the Louisiana coast. Two of these have been studied in detail, the abandoned St. Bernard (Parish) delta, lying chiefly to the east of New Orleans, and the living Plaquemines (Parish) delta, to

the southeast. Mound-building Indians occupied the former and the distribution of their potsherds indicates an eastward extent of the deltaic surface beyond the Chandeleur Islands. Coastal subsidence has reduced this surface to less than half of its former area and in doing so has created a number of submergence forms, among which are the curious "double islands" marking old natural levees. The lower 60 miles of the Plaquemines delta has been built since the time of the mound-builders and exhibits forms resulting from the essential opposition between river forces, tending to drive the shore irregularly outward, and Gulf forces, driving the shore inland and smoothing its outlines as it does so. In general, the contrast between the smooth western half of the existent Louisiana coast and the irregular eastern half is an areal expression of the relative dominance of these forces.

EDNA SCOFIELD. (Introduced by John B. Leighly.)

The Origin of Patterns of Occupation in Rural New England.

Two settlement forms predominate throughout rural New England and are associated intimately geographically: (1) the compact rural community, and (2) the isolated farmstead. Different types of villages recur in various areas. Also, recurring patterns are formed by the peculiar areal relationships which exist between compact villages and individual farms. The problems in this study concern the origin of these types of settlements and the patterns which recur in the rural landscape.

It is generally assumed that all of the towns of Colonial New England were founded in much the same fashion. As a fact the different conditions on the expanding frontier resulted in different methods of settlement during the various period of expansion. The towns, villages and farms established during any one period of expansion exhibit individual ground patterns as a rule.

In all the rural townships of New England today features of colonial origin may be found, *e.g.*, the location of the public buildings on a town common. In many townships extensive areas are held in common by the town, and in others evidences of dispersed land holdings persist.

The earliest settlements on the coast of New England were unplanned, but the dangers of attack by the Indians to which the settlers were exposed forced them to dwell compactly rather than in isolated farms. One of the first orders issued by the General Court of Massachusetts Bay was that all dwellings should be built within half a mile of the meeting house. This led to the development of a system of planned settlement.

All during the colonial period the General Court made grants of two sorts: (1) to groups of individuals and (2) to individuals. Those made to

individuals were large and were in recognition of public service as a rule. These grants were seldom settled upon by the owners, and frequently lagged far behind the other areas in settlement. The grants to groups of "proprietors" were generally in the form of a "town" or "township" from six to ten miles square, and for the purpose of settlement. Before 1713 grants to such groups of individuals were made only to actual settlers, but after that date there was a period of over forty years of land speculation during which large grants were made to groups of "proprietors" who were willing to try to induce people to settle on the grant. These speculators offered special inducements to the first pioneers who went out to settle on the grant, but charged fabulous prices for the land which they sold to settlers who came after the dangers of the frontier had been modified. The patterns of occupation developed during the period before 1713 and those developed after that date vary greatly. Before 1713 there were three periods of expansion and types of settlement, characterized by irregular ground plans and a variety of forms. The period after 1713 is characterized by more regular forms and by the recurrence of a few predominant forms. Out of the type of settlements established during the period after 1713 developed the township method adopted later under the "General Land Survey" by the Federal Government.

Ground patterns are illustrated by maps of representative areas. The stamp which these original forms have left on the present day landscape may be seen (1) in the shape of the townships, (2) in the ground patterns of the rural communities, (3) in the way in which the individual farms and the rural communities are associated areally, as seen on recent topographic maps.

GUY-HAROLD SMITH.

The Cartographical History of the Great American Desert.

The "Great American Desert" was given cartographic expression about 1821 or 1822 when the explorations of Pike, Long and others became known to the map makers. Gradually the so-called desert area, first restricted to a limited area in what is now western Kansas, southeastern Colorado, northeastern New Mexico, and the Panhandle areas of Oklahoma and Texas, was expanded to include most of the Great Plains. Cartographically the Great American Desert lasted for nearly a half century before it was finally eliminated from the maps of interior America. In the general and school atlases it lasted longest and thereby introduced a tradition which has persisted for a century in spite of the accumulation of quantitative rainfall data and the vigorous protestation of the inhabitants of the Great Plains.

HELEN M. STRONG.

Manufacturing Regions of the United States: Two Maps.

Manufacturing has meant different things at different times. The word *manufacturing* was coined in France more than 400 years ago by combining two Latin words meaning "to make by hand." Today, dictionaries define *manufacturing* as both hand and machine production, though, to people in general, to manufacture is to produce by machinery.

The United States was the first nation to take a census of manufacturing. This was done in 1810 and from 1810 until 1900 the censuses covered hand, household, and factory production without distinction between them, but, from 1905 on, the Census of Manufactures has included only factory products. There are literally thousands of more or less distinct types of manufacturing which have been classified somewhat differently in the various censuses. However, that of 1930 put them into 326 industries and 16 industry groups.

The regional distribution of these industries is the subject of the present study. In order to discover the limits of manufacturing regions, the integration and interrelation of the numerous manufacturing nuclei and of scattered manufacturing activities must be analyzed as woven into a regional pattern. Within a manufacturing region there are many areas devoid of factories, by the same token as that cotton, hay, or corn do not cover every acre in the cotton belt, the hay and pasture region, or the corn belt respectively. However, to be a manufacturing region, the region as a whole must possess binding elements of manufacturing homogeneity, and be industrially contrasted, or physically or economically separated, from surrounding regions.

The principal factors considered in delimiting manufacturing regions are: (1) the intensity and continuity of manufacturing over a given area; (2) the physiographic location and economic limits of an area; (3) the delimiting of areas having little or no manufacturing; (4) the interrelationship—economic and otherwise—between manufacturing centers or diffused areas of manufacturing.

Before manufacturing regions can be outlined the distribution of manufacturing must be mapped according to areas small enough to show gradual gradation from no manufacturing industry or almost none, to the most intensive factory concentration. The county statistics for combined horsepower capacity of prime movers—engines, turbines, and water wheels—and of electric motors in manufacturing establishments were selected. They were mapped by counties; on the basis of these figures and of field and other studies, first the isopleth map, and next the regional map was evolved.

The manufacturing regions distinguished are: the Northeast, Great

Appalachian Valley, the South, Florida, Industrial Middle West, Agricultural Middle West, Upper Mississippi Valley, East Dakota, Great Plains Railroad Division Points Areas, Rocky Mountain Piedmont, Salt Lake-Idaho, Northern Rocky Mountain, Cascade Irrigated Valleys, Pacific Northwest, California-Great Valley, and the Southwest.

OLIVE J. THOMAS. (Introduced by V. C. Finch.)

Some Inherited Characteristics in the Map of the Green Bay Portal.

The patterns, associations and landscape features of an area are frequently the accumulation of a series of past landscapes, culled, revised and remodeled according to the particular use which man at a certain period makes of the site and of the resources there available. Not infrequently may the map also display a kaleidoscopic view of the sequences of responses which have been made.

The present map of the Green Bay (Wisconsin) Portal well records the highlights of the past responses of man to his environment as follows:

1. In the name of the townships of Allouez and De Pere and in the name of the city of De Pere (a corruption of "Rapides des Pêres") is preserved the record of the French missionary activities at the Portal, at a site from which at that date a larger number of Indian tribes could be reached than from any other in the northwest, due to the concentration of fugitives, who, driven westward by the Iroquois, were seeking refuge in the forested glaciated swamp lands of Wisconsin to which the Fox-Wisconsin highway gave access.
2. The record of the French trading activities are preserved: (1) in the name of Fort Howard Military Reservation; (2) in the unplatted parcel of land located near the center of the city and formerly the site of French, British, and American Forts located at the Portal to safeguard the trading route to the Interior; and (3) in the axis of the street pattern as well as other cultural boundaries which are oriented at right angles to the river rather than along the true north-south lines adopted by the Federal Survey at a later date, and characterizing the major portion of the surrounding area.
3. The period of inception of urban nodes following the influx of American pioneers denoting a readjustment of the Portal to its hinterland, is recorded in the "Plat of Astor" carved from the lands owned by the fur traders but lost to the American Fur Company in payment for goods sold.
4. In the road pattern is recorded the fourth period of adjustment; that of the exploitation of the forest resources, when the roads were constructed to the source of power at the rapids at De Pere, and to the

harbor at Green Bay. The large acreages of unplatted water front are also an inheritance of the lumber period, when extensive sawmills lined the river bank.

5. The period of industrial growth based upon the exploitation of the woodlands for charcoal used in the iron furnaces conveniently established at the Portal, and the increase in commercial activity stimulated by the introduction of the railroad, are recorded in the large number of small unrelated plats which appear as meshes of heterogeneous size and arrangement upon the urban street pattern.
6. The present adjustment of man to his surroundings at the Portal is recorded in the union of urban nodes, and the expansion of suburban territory as the paper mills (the outgrowth of the lumber period), the cheese processing plants, and food canning factories (reflections of the agricultural character of the "umland") concentrate groups of people in certain favored locations.

The map of the Green Bay Portal is in reality an epitome of the geographical triad of Time, Place and People. It is still in the making, still plastic and will continue faithfully to depict the adjustments which man is constantly making to the opportunities and resources presented in his environment.

C. W. THORNTHWAITE.

Agricultural Prospects in the High Plains.

Since the day of the cattlemen, students such as Powell and D. W. Johnson have recognized that the High Plains are unsuited by nature to agriculture. Nevertheless, successive waves of agricultural settlers have invaded the area and since 1920, aided by development of large power machinery (tractor, combine, and one way) there has been a veritable deluge of settlers, and thousands of acres of native grass have been destroyed by the plow.

The recent series of drought years has brought discouragement and disillusionment to the farmers, has induced wind erosion to an unprecedented degree, and has again focused attention on the old question, still unanswered, as to whether or not a permanent agriculture can be established on the High Plains.

In this study an actuarial analysis of the climate of the Great Plains for the purpose of determining the limits of permanent agriculture has been attempted. The conclusion is reached that unless considerable retrenchment of agriculture and withdrawal of population is achieved there are only two alternatives for the area—either permanent poverty and distress or permanent subsidy.

JOSEPH M. TREFETHEN. (Introduced by Glenn T. Trewartha.)

A Method of Geographic Reconnaissance.

A method of geographic field work is proposed based on the principle of the Rosiwal petrographic analysis. In thin sections of rock prepared for microscopic examination, measurements of the intercepts of the different minerals along arbitrarily chosen lines are made by means of an ocular micrometer. The total length of the intercepts of any one mineral constituent reduced to percentage of the whole length of the lines measured gives the area in the slide covered by that mineral. In a similar way, quantitative estimates of land use may be made by pacing along traverse lines laid out across the area selected for study. The field geographer paces the length of the intercept of each type of land character he wishes to differentiate. The fractional system of notation used by field geographers is convenient to record these characters along the line of traverse platted in note-book or on base map. The total length of the intercepts of each specific type reduced to percentage represents the amount of the total area occupied by it. The amount of detail recorded on the traverse plat and the minuteness of land character subdivision will depend on the purpose of the study.

This method of field work has the advantage of covering area away from road frontage and thus gives a picture of the total areal content. Besides the qualitative information such as is obtained from any well conducted reconnaissance, this method gives quantitative data of a high degree of reliability. It is estimated that in most regions eight to ten miles of traverse can be run in a day's work by an individual field geographer.

The method has been tested in the field over an area of some twenty square miles north of the city of Columbia, Missouri. The results of this field study are incorporated to illustrate the application of the method to field work.

This method is also well adapted to office analysis of land use maps, and eliminates the tedium of planimeter measurements. Such an office application is shown by a comparison of data obtained by measurements across Finch's land use map of the Montfort area, Wisconsin, with the data secured by planimeter measurements.

STEPHEN S. VISHER.

The Desirability of More Maps of Regional Contrasts in Non-Average Temperatures and Precipitation With Illustrations from Indiana.

Plants and animals are affected by the actual atmospheric conditions, not by averages. Since life is fairly well adjusted to normal conditions, abnormal departures are especially important, and extremes impose barriers which must be overcome. The present study was made partly to discover

and disclose the significance of unusual temperature and rainfall conditions. The area selected is conspicuous for the general desirability of its climate, and is a small state with little contrast in latitude, longitude, altitude, or nearness to the ocean or to other striking climatic limits.

Fifty maps dealing with temperature and precipitation in Indiana have been prepared and have revealed many significant conditions not disclosed by the conventional maps of average annual temperature and precipitation. Ten of the disclosures of the study may be summarized here. (Thirty-two maps and a fuller statement of the findings will be published in the *Proceedings* of the Indiana Academy of Science.)

(1) The northward decline in annual average temperatures is due largely to the sharp decline in the cooler months because in July and August all parts of the state have about the same temperatures. (2) In very hot weather, also, temperatures are about as high in the north as in the south. Indeed, the state record of 113° is held both in the north and in the south. (3) In very cold spells, also, the contrast with latitude is slight, as about the same proportions of northern and southern Indiana have experienced more than 27° below zero. The state record of 33° below is held, however, at the north; but the next coldest record (−30°) is at the south. (4) Despite the slight difference in elevation in Indiana, various temperature maps, especially of the length of the growing season in non-average years, reveal very clearly the significance of even slight differences of altitude. For example, the higher southern area frequently has a shorter frost-free season than areas in northern Indiana. (5) The influence of Lake Michigan is scarcely discernible on the maps of annual average temperature and precipitation, but is clearly evident on the dates of the first killing autumn frost, and upon snowfall.

(6) In precipitation, also, the almost regular northward decline shown by annual averages is seen, on analysis, to be due chiefly to the fact that southern Indiana normally receives much more precipitation in winter than does northern Indiana. In summer, however, southern Indiana receives little or no more rainfall than central or northern Indiana; indeed, it often receives less. (7) In the distribution of drouths as well as of excessive rainfalls southern Indiana is the least fortunate large section of the state. (8) The border of the natural prairie area of Indiana is not evident on the maps of annual average conditions, but it coincides significantly with the eastern margin of the driest area in dry seasons, together with the area of exceptionally little snowfall. (9) The northern and southern margins in Indiana of the cornbelt proper are also seen to be climatic when various maps of non-average conditions are examined, the northern limit being a matter of temperature and the southern limit chiefly of July drouth. Annual aver-

ages are mute on this significant score. Finally, (10) The influence of slope is apparent on various maps of non-average conditions but scarcely discernible on those of annual averages. For example, the state's records for heavy rainfall are held near the top of a steep 500-foot slope near the Ohio River; likewise snowfall is often much heavier along the ridge of the Valparaiso moraine in northwestern Indiana than on either side.

In brief, in order to obtain a clear picture of the climate of an area, the maps of annual average conditions should be supplemented by numerous maps of non-average conditions. Desirable maps include those depicting conditions in 4 years out of 5, in 1 out of 5, in 1 out of 10, in 1 out of 20; and of record extremes of heat, cold, precipitation and drouth. Maps of such sorts should be made for each of the seasons of the year and for critical months as well as for the year as a whole. Hence, instead of the three conventional maps of annual averages of temperature, precipitation, and the growing season, scores of maps are desirable (40 were shown). Such maps help explain the distribution of native vegetation, crops, soil erosion and many other conditions of human significance. They also, in regions of slight relief, reveal far better than do maps of annual averages, the significance of altitude, slope, and the effect of bodies of water.

STEPHEN S. VISHER.

The Public Domain: Successive Programs for its Disposal or Use.

(No abstract received.)

HAROLD B. WARD. (Introduced by William H. Haas.)

The Development of Transportation Lines in the Hamilton, Ontario, Area.

Topography has been of great importance in the development of transportation lines in the Hamilton area although other factors have at times played major rôles. Hamilton has a unique physiographic setting at the base of the Niagara Escarpment bordered by a land-locked bay. The city, of which the larger part is more than 300 feet below the top of the escarpment, now appears as an extensive rectangular complex with a long east-west axis but a significant spread on the upland. From the day of the Indian trail to the epoch of the modern highway the Niagara Escarpment has retarded the development of land transportation lines. Minor topographic features on the plain of glacial Lake Iroquois have influenced the routes of transportation, particularly in the city. The first railroad, which became a dominant factor in the development of manufacturing in Hamilton, was built in spite of topographic difficulties and because of one of the many early railroad charters which was acted upon largely through the influence of a single Canadian statesman. In recent years the city has

become a leading highway center with a rich tributary area. Transportation by water, which has passed through several stages, is now of tremendous commercial importance.

RUSSELL WHITAKER.

Peninsular Ontario.

Peninsular Ontario has come to be regarded as possessing essential uniformity in its natural aspects and in features of agricultural land use, and noteworthy diversity in its industrial development. These conclusions have been critically examined in a field and documentary study of the problem of regional uniformity as it is presented in this area. The conditions found to be common to the region as a whole are described. Attention is also directed to elements of diversity, but is limited to those contrasts which have significance in regional frameworks of continental and world-wide extent.

R. H. WHITBECK.

Man and Nature in the Hawaiian Islands.

(No abstract received.)

C. LANGDON WHITE.

Cleveland and Its Cuyahoga River Problem.

The Cuyahoga River has from the beginning of white settlement presented difficulties to navigation. When Moses Cleaveland and his surveyors arrived at the river's mouth in 1796, they found a large sandbar closing the entrance to large boats. This bar was eliminated early in the nineteenth century. With improvement in the art of navigation and in ships, however, other defects in the Cuyahoga have become intensified.

The river harbor is Cleveland's industrial harbor. Land on the lake front is too expensive and the width of land from the harbor line to the high bank is too narrow to permit of its use by large industries. The outstanding plants in the Flats are those engaged in the manufacture of iron and steel; 90% of the tonnage on the Cuyahoga consists of iron ore and limestone.

The river's most glaring defect today is its narrow and tortuous course. The Indians applied the term *cayhaga* (crooked) to the river; hence the derivation of Cuyahoga. Bends are so abrupt and bridges so numerous and low that navigation has become painfully slow and difficult. Bulk freighters require about five hours to travel the five miles from the Cuyahoga's debouchure to the upper steel plants. Moreover, they must be towed both loaded and light. Captains have testified that they prefer to take a cargo to any port on the lakes than to Cleveland, providing the cargo is bound up the river. The depth of twenty feet is satisfactory but so kinky is the river that vessels longer than 450 feet cannot ascend above the Detroit Superior

Bridge. Prior to 1900 all lake vessels could navigate the river, but since then larger boats have been constructed because of their greater economy. By 1924 only 32% of all lake carriers could use Cleveland's inner harbor. The seriousness of this for the future is evident. Soon vessels will be unable to deliver materials to the upper river plants without a substantial extra charge. It is estimated that a saving of at least six cents per ton is effected when iron ore is shipped in a vessel 600 feet long with a capacity of 12,000 tons as against one 400 feet long with a capacity of 6,000 tons and to this should be added about two cents to cover the added cost of unloading the smaller boat.

Bridges too are objectionable and there are twenty-four in the five-mile stretch to the upper steel plants. Especially are the movable bridges objectionable.

Improvement of the Cuyahoga is justifiable and imperative if Cleveland is to retain metallurgical plants already established and attract additional ones. The iron and steel industry means much to Cleveland: it employs about 8,000 men, has a payroll of about $17,000,000 per year, and contributes annually about $1,400,000 in taxes. Moreover, Cleveland is an excellent locale for the industry, because its cost of assembling ore, coal and limestone is lower than in any other district using Lake Superior ore. It is also advantageously situated with respect to markets. While many excellent proposals for river improvement have been made, each yearly delay has augmented the cost and difficulties until now the most practicable, though not the best, scheme consists of making seven cuts in the existing banks of the river together with the alteration or complete removal of certain obstructing and unnecessary bridges. Proper dredging also must be provided.

A. J. WRIGHT. (Introduced by Guy-Harold Smith.)
Ohio Town Patterns.

Initiated by the two methods of survey employed in the first regular system of public land disposal in the United States, there has arisen in Ohio a pattern of urban occupance the gross features of which are considered in this study. Developed upon contiguous portions of lake plain, till plain and Allegheny plateau, these agglomerations exhibit related features of areal structure many of which have persisted throughout the successive economics obtaining there. Prevailing over most of Ohio is the welding of the riverine and rectangular grill. Major factors in the modification of this plan include the original grants, relief, and the degree of flood control. the principal exception to the above plan is in the south-central portion where neither orientation nor pattern are accordant with the rest of the State.